Mucosal Morbidity in Patients With Epidermolysis Bullosa Acquisita

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Background: Epidermolysis bullosa acquisita is an acquired inflammatory and/or dermolytic subepidermal blistering disease characterized by IgG autoantibodies to type VII collagen. Four patients with documented epidermolysis bullosa acquisita were evaluated by a multidisciplinary team of care providers (4 dermatologists, an ophthalmologist, a radiologist, a voice and speech specialist, and an otolaryngologist) for 1 to 5 years to characterize mucosal involvement and its complications and response to treatment. Patients were evaluated clinically and by slitlamp examinations, endoscopies, computed tomographic scans, and videofluorographic swallowing studies. Spiral computed tomographic scans for virtual endoscopy were used for the nontraumatic evaluation of airways in 2 patients with respiratory tract compromise.

Observations: Involvement of 5 or more mucosal sites—mouth, nose, conjunctiva, pharynx, and larynx—was documented in all patients. Complications included ankyloglossia, periodontal disease, scarring and crusting of nasal mucosa, symblepharon formation, obstruction of nasolacrimal ducts, deformation of the epiglottis, impaired phonation, dysphagia, esophageal strictures, and supraglottic stenosis requiring emergency tracheostomy.

Conclusions: Epidermolysis bullosa acquisita may extensively (or predominantly) affect mucosal epithelia in a manner resembling cicatricial pemphigoid. Mucosal disease in these patients is often subclinical, can lead to serious complications, and is best managed using a multidisciplinary approach.

Arch Dermatol 1999;135:954-959

E PIDERMOLYSIS bullosa acquisita (EBA) is an acquired subepidermal blistering disease characterized by an autoimmune response to type VII collagen. Clinical features of EBA range from inflammatory subepidermal blisters that are indistinguishable from those in patients with bullous pemphigoid to dermolytic lesions that resemble those seen in patients with dystrophic epidermolysis bullosa. In addition to cutaneous disease, EBA can affect mucous membranes or even present as a mucosal-predominant disorder that mimics cicatricial pemphigoid. In the past 5 years, mucous membrane involvement in 4 patients with well-documented EBA has been evaluated and managed by a multidisciplinary team. In this report, we describe the character and extent of mucosal disease in these patients; document the complications of such involvement; summarize the team management of these patients’ mucosal disease; and report the use of noninvasive imaging techniques for the evaluation of anatomic and functional characteristics of pharyngolaryngeal involvement in patients with EBA with respiratory tract compromise, dysphagia, or both.

RESULTS

SKIN

Clinical and laboratory data regarding these patients are summarized in Table 1 and Table 2. All patients had cutaneous disease, although of varying severity. Patient 1 presented with widespread inflammatory blisters that responded well to tapering daily doses of dapsone and prednisone (200 mg and 60 mg tapered to 0 mg over 12 and 21 months, respectively). Patient 2 had widespread chronic inflammatory and dermolytic disease that resulted in the mutilation of fingers, hands, and scalp. Patient 3 had dermolytic lesions that dominated on the extremities and healed as atrophic, hyperpigmented scars with associated milia. Cutaneous alterations in patient 4 were described earlier.

ORAL CAVITY

All patients had involvement of their oral mucosa; lesions were consistently painful and at times impaired food intake. In patient 1, despite initial widespread involvement of the oral mucosa, gingi-
PATIENTS AND METHODS

PATIENTS

Four patients (aged 32-43 years) with EBA (duration, 3-14 years) were studied; 1 patient has been previously described in part. All patients had some degree of inflammatory or dermolytic skin lesions at presentation. Additional criteria for the diagnosis of EBA were the presence of deposits of IgG and C3 in epidermal basement membrane and either circulating IgG autoantibodies that bound the dermal side of 1-mol/L sodium chloride split skin in indirect immunofluorescence microscopic studies and type VII collagen by immunoblotting, or in situ deposits of IgG on anchoring fibrils as determined by direct immunoelectron microscopy.

LABORATORY STUDIES

Direct and indirect immunofluorescence microscopy studies were performed as described previously. Normal-appearing perilesional skin of patients with undetectable circulating anti-type VII collagen autoantibodies was studied by direct immunoelectron microscopy to locate in situ deposits of IgG. Extracts of lamina densa-dermis from normal human skin were studied by immunoblotting to detect the presence of IgG autoantibodies to type VII collagen, as described.

IMAGING STUDIES

A flexible nasopharyngoscope (Precision Instrument Division, Olympus Corp, Melville, NY) or a straight nasal endoscope was used to visualize the nasal mucosa, epiglottis, pharynx, larynx, and proximal esophagus. Swallowing function was evaluated by a modified barium swallow study recorded videofluoroscopically. The oropharyngeal and esophageal phases of swallowing were assessed with 3 textures—liquid (10 mL), puree (5 mL), and graham cracker (one quarter piece)—in both lateral and posterior planes. Videotapes were studied to assess oropharyngeal function, the duration of swallowing phases, and the movement of bolus materials from the oral cavity to the esophagus.

Spiral computed tomographic (CT) studies of the supraglottic and subglottic regions were used as a noninvasive imaging technique in 2 patients in whom airway compromise developed. The CT scans were done helically (High-Speed Advantage; General Electric Medical Systems, Milwaukee, Wis) during slow inspiration or expiration using a 3- or a 5-mm-section thickness and a helical pitch of 1.0 or 1.3. The CT scans were processed using a surface-rendering technique (virtual endoscopy) that sculpts away all soft tissues of the neck and produces a 3-dimensional model of the airway contour. Data were displayed on a specialized computer workstation (Indigo 2 Maximum Impact; Silicon Graphics, Mountain View, Calif) capable of interactive manipulation and “fly-through virtualization” (ie, simulated endoscopy) of the 3-dimensional models. Results of these studies were compared with the findings of endoscopy.

REPORT OF A CASE

Patient 4, a 36-year-old man from Guyana, was referred for the evaluation of oral and nasopharyngeal blisters and erosions. The patient reported that similar lesions had developed on his skin between 1985 and 1993; subsequently, lesions had been confined to his mucous membranes. His history referable to this involvement included chronic sinusitis requiring intermittent antibiotic therapy, gastroesophageal reflux, hoarseness, and an esophageal stricture treated successfully with bougienage in 1995. Despite intermittent treatment with dapsone and prednisone (the former of partial and the latter of minimal benefit), the disease continued to progress. Although intermittent treatment with dapsone and prednisone (the former of partial and the latter of minimal benefit), the disease continued to progress. Although intermittent treatment with dapsone and prednisone (the former of partial and the latter of minimal benefit), the disease continued to progress. Although intermittent treatment with dapsone and prednisone (the former of partial and the latter of minimal benefit), the disease continued to progress. Although intermittent treatment with dapsone and prednisone (the former of partial and the latter of minimal benefit), the disease continued to progress. Although intermittent treatment with dapsone and prednisone (the former of partial and the latter of minimal benefit), the disease continued to progress.

In contrast, patient 2 had severe oral involvement characterized by blisters, erosions, and scarring that resulted in ankyloglossia, mandibular contracture, and a notably restricted oral aperture. All patients had gingivitis; patients 2 and 4 had severe involvement resulting in marked periodontal disease, substantial alveolar bone loss, and freely mobile teeth.

NASAL CAVITY

In addition to oral lesions, chronic, erosive, and crusted lesions developed in the nasal mucosa of all patients. Three patients reported bouts of recurrent, yet mild, epistaxis. Patients 2 and 4 had severe involvement that resulted in scarring and obliteration of the turbinates. Patient 4 also had synechiae between his nasal septum and the remnants of the right inferior turbinate, occlusion of the nasolacrimal duct in the right inferior meatus, and episodes of acute and chronic sinusitis.

EYES

Three patients had evidence of either or both medial and lateral symblepharon formation and subepithelial fibrosis of the palpebral conjunctivae. In contrast to most other types of cicatrizing conjunctivitis where broad-based symblepharon occurs in the inferior or superior fornices and is preceded by foreshortening, symblepharon and sites of subepithelial fibrosis in these patients were extremely focal and atypically located. Patients 2 and 3 had alteration of the anatomy of the caruncle and plica semilunaris, which did not cause symptoms but did signify previous subclinical conjunctival involvement. Patients 3 and 4 had involvement of lacrimal puncta, with an unusual pattern of adjacent conjunctival cicatization resulting in partial or complete obstruction of the superior puncta. Although all patients had conjunctival cicatization, only those with involvement of the lacrimal excretory systems were symptomatic.
forearms, elbows, thighs, knees, legs, and trunk; body hair density within scars was decreased. Fingernails and toenails were normal; there were no milia or blisters on the patient's skin. The oral mucosa showed sites of erythema and erosion. The tongue was depapillated and scarred, and the buccal mucosa was also scarred. The gingivae were recessed and bled on touch. Multiple teeth in all 4 quadrants were mobile; radiographs identified severe generalized alveolar bone loss. Otolaryngological consultation and nasopharyngoscopy revealed extensive crusts overlying denuded sites on the nasal mucosa, the obliteration of nasal turbinates, the loss of other intranasal anatomical landmarks, a globular epiglottis, eroded mucosa covering the supraglottic region and the true and false vocal cords, and a 2- to 3-mm synchia between the left arytenoid and the posterior hypopharyngeal wall.

As summarized in Table 1, laboratory test results substantiated the diagnosis of EBA. The patient was initially treated with cyclosporine (2.5 mg/kg of body weight per day), dexamethasone elixir in a “swish-and-spit” regimen 3 times each day, and twice-a-day nasal irrigations with isotonic sodium chloride solution, followed by nasal lubricant (Ponaris). Cyclosporine therapy was discontinued after 6 weeks because of sustained elevations in serum creatinine levels. Subsequent stepwise and beneficial additions to the patient’s treatment regimen included omeprazole, 20 mg a day; occluded application of cloetasol propionate to the gingivae 4 times each day (in place of dexamethasone); frequent dental cleanings; and beclo-methasone nasal spray twice each day.

Nine months after his initial presentation, the patient reported difficulty swallowing and a 4.5-kg weight loss. A barium swallow study revealed narrowing of the cervical esophagus at the level of the pyriform sinuses and aspiration of barium into the trachea. Upper gastrointestinal tract endoscopy showed notable dilation of the pyriform sinuses and a broad adhesion between the interarytenoid region and the posterior hypopharyngeal wall that had not been seen on previous examinations (Figure 1). Videofluoroscopic swallowing studies verified the esophageal inlet stenosis and identified the pooling of food in dilated pyriform sinuses, aspiration during swallowing, and the use of multiple swallows to empty material pooled in the pyriform sinuses. Spiral CT scanning for virtual endoscopy confirmed the epiglottic and laryngeal deformities (Figure 2) but indicated that there was no evidence of subglottic stenosis.

Under general anesthesia, the patient underwent direct laryngoscopy and carbon dioxide laser excision of cricopharyngeal scars and the most proximal aspects of the large adhesion between the posterior mucosa and the posterior hypopharyngeal wall. Although the esophageal inlet was significantly expanded, it was not possible to ablate the large adhesion because its longitudinal dimension was too extensive (ie, it represented a vertically oriented esophageal stricture). Immediately following laser surgery and while the patient was still subject to general anesthesia, the cricopharyngeal area was injected with triamcinolone acetonide (30 mg at a concentration of 40 g/L). The patient had an uncomplicated postoperative course, no complications from endotracheal intubation, and immediately improved swallowing function. He regained his lost weight during the ensuing months; serial endoscopy found no recurrent strictures in the proximal esophagus up to 18 months after the operation.

In mid-1998, the patient noted intermittent irritation of the right eye associated with episodes of epiphora and discharge. Slitlamp examination revealed conjunctival scarring and medial and lateral symblepharon of both eyes. Of note, there was partial occlusion of the superior punctum of the right eye and stenosis of the superior punctum of the left eye. Compression of the right lacrimal sac resulted in the regurgitation of mucoid discharge from the inferior punctum, indicating stasis in the lacrimal outflow system. Obstruction of the right nasolacrimal duct ostium beneath the inferior meatus was noted by nasal endoscopy. Treatment with prednisolone acetate, 0.12% ophthalmic solution; bacitracin ophthalmic ointment; and massage of the lacrimal sac resolved associated symptoms.

**PHARYNX OR LARYNX**

Although symptoms referable to the pharyngolaryngeal area were sometimes minimal, all patients showed disease activity in this relatively inaccessible anatomic region. Patient 1 had a slightly globular and minimally thickened epiglottis, several pharyngeal and laryngeal erosions, and erythema of the arytenoids. Patient 2 had a bulbous, thickened, and U-shaped epiglottis that was displaced posteriorly due to interarytenoid and aryepiglottic fold fusions (Figure 2). The latter resulted in progressive supraglottic stenosis and eventually acute airway compromise requiring tracheotomy in 1996. Despite daily treatment with cyclosporine (2.5-4.0 mg/kg each day) and prednisone (10-20 mg/d) for the past several years, the patient’s current maximal glottic “chink” (ie, space between the vocal cords) is about 2 mm. Endoscopy of patient 3 revealed erythema of the arytenoids and true vocal cords—findings thought to be directly related to her gastroesophageal reflux. Alterations in patient 4 were described earlier. The pharynx, larynx, and trachea were also evaluated by spiral CT with computer-aided 3-dimensional reconstruction in patients 2 and 4. This virtual-endoscopy technique provided images that were comparable to those obtained by direct visualization (Figure 2) and allowed the supraglottic and subglottic regions to be evaluated noninvasively.

**SWALLOWING**

Patients 1, 3, and 4 underwent noninvasive, functional swallowing studies of barium contrast–impregnated solid, semisolid, and liquid materials. Videofluoroscopy revealed that all patients had difficulty during the pharyngeal phase of swallowing. During patient 4’s most pronounced esophageal impairment, he had extensive swallowing difficulties, with pharyngeal bolus retention of food and bouts of aspiration. As observed by videofluoroscopy, liquids were more consistently aspirated than solid or semisolid foods. Furthermore, many instances of aspiration were completely subclinical, eliciting no coughing or foreign body sensations.

**VOICE**

All patients reported changes in their voice quality as a consequence of EBA. Patients 1 and 3—patients with active but
less severe manifestations of disease—reported occasions when they temporarily (ie, for 12-36 hours) lost their voice following loud singing or shouting. Patient 2 experienced a progressive decline in phonation over many years. Following his tracheotomy in 1996, the volume and tonal consistency of his voice declined even further. Although his most recent endoscopy studies revealed a minimal airway diameter, he remains capable of speaking with the assistance of a Passy-Muir valve fitted onto his tracheostomy tube. Since the time of his first presentation to dermatologic services...

Table 1. Cutaneous and Laboratory Findings in Patients With Epidermolysis Bullosa Acquisita

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Duration, y</th>
<th>Major Cutaneous Findings</th>
<th>Laboratory Findings*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M/32</td>
<td>3</td>
<td>Initial widespread inflammatory blisters, gradually evolving into dermolytic lesions primarily on the dorsum of hands and posterior thighs</td>
<td>Immunochemistry</td>
</tr>
<tr>
<td>2/M/43</td>
<td>14</td>
<td>Chronic, severe, widespread dermolytic mutilating disease with scarring alopecia, loss of nails, digital fusion, and contractures</td>
<td>IgG, C3c, IgE, IgA, IgM</td>
</tr>
<tr>
<td>3/F/36</td>
<td>4</td>
<td>Dermolytic lesions confined to areas of trauma, including hands, elbows, knees, and feet</td>
<td>IgG, C3c</td>
</tr>
<tr>
<td>4/M/36</td>
<td>12</td>
<td>Initial widespread inflammatory blisters evolving into dermolytic skin disease primarily affecting lower legs</td>
<td>IgG, C3c†</td>
</tr>
</tbody>
</table>

*All immunoreactants were present in a continuous, linear pattern in epidermal basement membrane. Results of indirect immunofluorescence (IF) studies correspond to titers of IgG anti–basement membrane autoantibodies directed exclusively to the dermal side of the test substrate. Immunoelectron microscopy of patients’ skin showed in situ deposits of IgG in the sublamina densa region overlying anchoring fibrils. Immunoblot studies were performed on extracts of lamina densa and dermis as described previously. ND indicates not done.

†Findings of direct IF testing were positive only on the patient’s split-skin specimen; all in situ deposits of IgG and C3c were confined to the dermal side of the patient’s split skin.

Figure 1. Preoperative view of stenosis of esophageal inlet in patient 4. The inlet is the small opening just left of the broad adhesion between the arytenoids, postcrioid mucosa, and the posterior hypopharyngeal wall. The broad adhesion was reduced with carbon dioxide laser surgery.

Figure 2. Spiral computed tomographic (CT) imaging with 3-dimensional computer reconstruction (ie, virtual endoscopy) is comparable to flexible endoscopy for visualizing structures in the hypopharyngeal and laryngeal regions of patients with epidermolysis bullosa acquisita. Spiral CT images (A, C, and E) are compared with results of laryngoscopy (B, D, and F); the anterior plane is at the top of each panel. Displayed are the vocal cords of patient 4 (A and B), the bulbous and globular-appearing epiglottis of patient 4 (E and D), and the markedly thickened and U-shaped epiglottis of patient 2 (E and F). Although virtual endoscopy allowed noninvasive imaging of morphologic alterations, endoscopy was essential for the identification of superficial lesions (eg, blisters and erosions) and their extent of involvement.
In 1996, patient 4 has had a raspy, hoarse voice. Laryngeal involvement (exacerbated or initiated by gastroesophageal reflux) was deemed responsible.

**ESOPHAGUS**

In addition to the mucosal disease described earlier, patients 2 and 4 had esophageal erosions and strictures. In patient 2, these lesions were successfully treated by balloon dilation under direct visualization as described. Patient 4’s lesions were summarized earlier.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Mouth</th>
<th>Nose</th>
<th>Eyes</th>
<th>Pharynx and Larynx</th>
<th>Esophagus</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial erosive and bullous lesions of buccal mucosa, palate, and tongue; transient mild gingivitis</td>
<td>Minimal dried sanguineous discharge; denuded mucosa of nasal vestibule; pale and hypertrophic inferior turbinates; anatomic landmarks preserved; occasional mild epistaxis</td>
<td>Focal medial symblephara OU; follicles of medial bulbar conjunctiva OS; thickening of conjunctivae overlying lacrimal glands OU; enlarged lacrimal glands OU</td>
<td>Presented with slightly globular and minimally thickened epiglottis, eroded mucosa at petiolar and lingual surface of epiglottis, and erythema of arytenoids; hoarseness and loss of voice after shouting</td>
<td>No involvement</td>
<td>Perianal lesions during initial inflammatory phase of disease</td>
</tr>
<tr>
<td>2</td>
<td>Chronic, severe oral involvement with blisters, erosions, and scars; ankyloglossia; gingival recession, alveolar bone loss, and loss of teeth; mandibular contraction resulting in impaired ability to open mouth</td>
<td>Extensive dried and moist sanguineous discharge; extensive fibrosis with obliteration of anatomic landmarks; recurrent mild epistaxis</td>
<td>Focal cicatricial bands laterally OD; foreshortening of inferior lateral fornix OS; subepithelial fibrosis inferior palpebral conjunctivae OU; fusion of caruncle and plica semilunaris</td>
<td>Bulbous, thickened, and U-shaped epiglottis; interarytenoid and aryepiglottic fold fusion resulting in supraglottic stenosis and airway compromise requiring tracheotomy</td>
<td>Strictures in middle and distal esophagus</td>
<td>Erosions of the penile shaft</td>
</tr>
<tr>
<td>3</td>
<td>Erosions on the inner lip, buccal mucosa, and tongue; gingivitis</td>
<td>Minimal dried sanguineous discharge; anatomic landmarks preserved; recurrent mild epistaxis</td>
<td>Focal medial and lateral symblephara with secondary occlusion of superior puncta OU; subepithelial fibrosis of superior palpebral conjunctivae; loss of caruncle OS</td>
<td>Erythema of arytenoids and vocal processes of true vocal cords; interarytenoid cobblestoning; occasional hoarseness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Erosions of the lips, buccal mucosa, palate, and tongue; gingival recession, severe alveolar bone loss, and mobile teeth</td>
<td>Extensive dried and moist sanguineous discharge; extensive fibrosis and synechiae between septum and turbinates; choanal stenosis; anatomic landmarks obliterated; recurrent mild epistaxis; chronic sinusitis</td>
<td>Focal medial and lateral symblephara OU; partial occlusion and/or stenosis of superior puncta OU; foreshortening of medial fornices OU; bulbar conjunctival scarring adjacent to limbus OU; follicles of medial bulbar conjunctivae OD; subepithelial fibrosis and infiltrates palpebral conjunctivae; nasolacrimal sac involvement OD</td>
<td>Globular, “knobby” epiglottis; eroded mucosa on supraglottis and true and false vocal folds; fibrosis, scarring, and synechiae between posteriorcricoid mucosa and posterior hypopharyngeal wall, obliterating the cricopharyngeal region of the esophagus; retention of bolus on swallowing; chronic hoarseness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In most patients with EBA, chronic demolytic lesions develop either initially or following a phase of disease characterized by inflammatory subepidermal blisters. With prolonged dermolytic disease, scarring becomes notable and can obliterate normal structures such as hair and nails. As shown in this study, EBA can affect mucous membranes in an analogous, progressive manner. Such lesions cause particular morbidity to mucosal epithelia that are typically juxtaposed and subject to bridging scars, strictures, wound contraction, and tissue loss. Furthermore, as demonstrated by many of our patients, mucosal involvement can be subclinical, chronic, and prone to life-threatening complications before symptoms referable to the erosive lesions themselves are identified. Laryngeal and pharyngeal mucosal involvement appears to be particularly susceptible to such silent complications, as demonstrated by 2 patients in this series in whom marked airway deformity developed before major symptoms arose.

In this study, evaluation of the nasal cavity, pharynx, and larynx by endoscopy and of the eyes by slitlamp ex-
amination provided particularly important information. Both procedures were quickly performed on an outpatient basis with minimal discomfort and no complications. In addition, noninvasive videofluoroscopy swallowing studies provided important data about the structure and function of our patients’ oropharyngeal and proximal esophageal regions. The results of these studies exceeded information provided by traditional barium swallow studies (which, in our experience, evaluated middle to lower esophageal and gastroesophageal regions more critically). In patients with substantial pharyngeal and laryngeal involvement, CT scans and virtual endoscopy also provided meaningful information about airway diameter and integrity both above and below the true vocal cords. By excluding the existence of subglottic stenosis, these studies were helpful in preoperative decisions regarding the treatment of patient 4 and also guided the management of patient 2’s airway compromise. Because of its noninvasive nature, virtual endoscopy has the potential to play an increasing role in the evaluation of airways in patients with diseases characterized by epithelial fragility (eg, epidermolysis bullosa). This technique appears to hold particular promise for the evaluation of the subglottic region of adults and all airways of children (ie, sites and subjects, respectively, often difficult to evaluate nontraumatically by endoscopy).

The management of patients with EBA in this series was guided substantially by the extent of their mucosal disease. Local measures of particular importance included the use of topical corticosteroids under occlusion for gingival and oral mucosal disease, regular irrigations with isotonic sodium chloride solution and intranasal lubricant (Ponarbis) for nasal involvement, and topical corticosteroids for ocular disease. Symptoms of gastroesophageal reflux in all patients responded to treatment with antacids, histamine 2-receptor antagonists, or proton pump inhibitors. Because gastroesophageal reflux can cause substantial laryngeal injury and voice impairment, aggressive treatment of this disorder is warranted in patients with EBA who are already at risk for mucosal disease.28 As reflected by patients in this series and by previous reports,1,7 EBA remains largely a disease resistant to treatment with parenteral agents. Although the inflammatory disease in patient 1 remitted following treatment with tapering daily doses of dapsone and prednisone, the other patients in this series had chronic, active dermatolytic disease. The use of cyclosporine (alone and in combination with prednisone) proved of partial benefit in 1 patient but had to be discontinued in another because of sustained elevations of serum creatinine levels. Recently, 2 patients in this series were treated with daclizumab (a humanized monoclonal antibody directed against the interleukin 2 receptor); to date, no significant responses or complications from the use of this agent have been observed.

Accepted for publication March 24, 1999.

We thank Robert A. Briggaman, MD, Department of Dermatology, University of North Carolina, Chapel Hill, for performing direct immunoelectron-microscopy studies on patients 3 and 4, and Harry Schaefer for assistance in preparing illustrations presented in this article.

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