**Denouement and Discussion**

**Coughing Paroxysms Associated With Subconjunctival Hemorrhage and Dellen**

Subconjunctival hemorrhages are among the most frequent diagnoses in ophthalmology and commonly occur following trauma. Simultaneous periocular and subconjunctival hemorrhages are reported in a few diseases, including coagulopathic states, thrombocytope尼亚, trauma (occult or known), metastatic neuroblastoma, rhabdomyosarcoma, and leukemia. Our patient had no history of trauma, coagulopathy, or blood dyscrasias. His only medical condition was mild persistent asthma, which was controlled with inhaled corticosteroid (400 µg/d). The coughing paroxysms suggested the cause of the subconjunctival hemorrhages and eyelid ecchymosis. Causes of coughing paroxysms are listed in **Table 1**.1

Although our patient had received all 4 scheduled pertussis vaccinations (diphtheria-pertussis-tetanus) and taken erythromycin for 1 week, we thought pertussis was the probable cause of the coughing paroxysms. The nasopharyngeal culture was negative for *Bordetella pertussis*; however, previously immunized patients are known to have a lower rate of positive cultures when infected. Patients previously treated with antibiotic agents may also have negative nasopharyngeal cultures for *B pertussis*. According to the clinical- and laboratory-confirmed case definitions of pertussis recently adopted by the Centers for Disease Control and Prevention in collaboration with the Council of State and Territorial Epidemiologists (Table 2),2 our patient met the criteria for diagnosis of probable pertussis.

Ophthalmologic complications of coughing paroxysms in pertussis infection include hemorrhages of the subconjunctival space, orbit, and anterior chamber, and, rarely, the retina and ocular adnexa.2-6 The characteristic forceful coughing paroxysms associated with a strong Valsalva maneuver sufficiently explain all of the known associated ocular findings. The unexpected finding in our patient was the localized thinning areas in the periphery of the corneas or dellen. This is a unique case of coughing paroxysms associated with dellen secondary to subconjunctival hemorrhage.

Dellen may be observed as localized thinning in the cornea and the sclera, adjacent to corneal and conjunctival elevations such as subconjunctival hemorrhage, pterygium, limbal tumor, and postsurgical edema. They are thought to be localized in areas of dehydrations, owing to the surface abnormalities of the tears. In our patient, the extensive subconjunctival hemorrhage probably led to lack of wetting by the eyelids.

The diagnosis is obvious at slitlamp examination. Rapid onset, location adjacent to elevations, lack of infiltration, and coverage by intact epithelium differentiate these thinning areas from ulcerations. The diagnosis of dellen may also be confirmed during therapy. Just taping the eyelids closed may lead to improvement in 1 to 2 hours, and total disappearance will occur over 24 to 48 hours.7 If hydration is not restored, the corneal stroma may undergo secondary degeneration leading to localized scarring and vascularization. Therefore, management should include treatment with artificial tears and lubricant supplements, eye patching, and close follow-up until the subconjunctival hemorrhage subsides. In our patient, dellen resolved in 5 days after supplemental therapy with artificial tears and lubricants. However, unilateral eye patching, with periodic alternation of which eye is patched, is recommended because bilateral eye patching is not easily tolerated. The therapy was continued for 3 weeks until the subconjunctival hemorrhages resolved. Elimination of the cause is mandatory for permanent recovery.8

Although dellen is usually innocuous and transient, it may be easily overlooked at penlight examination. Pediatricians should be aware of ocular complications of

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**Table 1. Differential Diagnosis of Persistent Cough**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Differential Diagnosis</th>
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<tbody>
<tr>
<td>Viral infections</td>
<td>Adenovirus species, Influenza A and B, Respiratory syncytial virus, Rhinovirus</td>
</tr>
<tr>
<td>Bacterial infections</td>
<td>Chlamydia pneumoniae, Streptococcus pneumoniae, Haemophilus influenzae, Tuberculosis</td>
</tr>
<tr>
<td>Noninfectious causes</td>
<td>Cough variant asthma, Foreign body, Postnasal drip, Gastrointestinal reflux, Malignancy</td>
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</table>

**Table 2. Case Definition for Pertussis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Clinical case definition</td>
<td>Cough illness lasting ≥2 weeks with one of the following: paroxysms of coughing, inspiratory whoop, or posttussive vomiting, without other apparent cause</td>
</tr>
<tr>
<td>Laboratory criteria for diagnosis</td>
<td>Isolation of <em>Bordetella pertussis</em> from clinical specimen or positive polymerase chain reaction for <em>B pertussis</em></td>
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<tr>
<td>Case classification</td>
<td>Probable case: Meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case. Confirmed case: Is laboratory confirmed or meets the clinical case definition and is either laboratory confirmed or epidemiologically linked to a laboratory-confirmed case.</td>
</tr>
<tr>
<td>Comments</td>
<td>In outbreak settings, may be defined as cough illness lasting ≥2 weeks without other symptoms. Direct fluorescent antibody testing should not be relied on for laboratory confirmation. Serologic testing is not standardized and is not used for national reporting purposes.</td>
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</table>

*Modified from criteria developed by the Centers for Disease Control and Prevention and the Council of State and Territorial Epidemiologists.*

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coughing paroxysm, especially if there is extensive subconjunctival hemorrhage disturbing distribution of the tear film layer.

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Trial Registration Required

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For details about this new policy, and for information on how the ICMJE defines a clinical trial, see the editorials by DeAngelis et al in the September 8, 2004 (2004;292:1363-1364) and June 15, 2005 (2005;293:2927-2929) issues of JAMA. Also see the Instructions to Authors on our Web site: www.archpediatrics.com.