Dry Eye Symptoms and Chemosis Following Blepharoplasty

A 10-Year Retrospective Review of 892 Cases in a Single-Surgeon Series

Jess Prischmann, MD; Ahmed Sufyan, MD; Jonathan Y. Ting, MD; Chad Ruffin, MD; Stephen W. Perkins, MD

Objectives: To determine the incidence of and risk factors associated with dry eye symptoms (DES) and chemosis following upper or lower blepharoplasty. To examine the outcomes among long-term blepharoplasty data to better understand the incidence of and risk factors associated with dry eye symptoms (DES) and chemosis, to evaluate the known risk factors for DES in the general population, and to analyze intraoperative procedures (such as forehead-lift, midface-lift, canthopexy, and canthoplasty) to determine their effects on DES and chemosis.

Methods: A retrospective medical record review was performed among all the cases of upper or lower blepharoplasty performed by the senior author during a 10-year period (January 1999 through December 2009). A self-reported dry eye questionnaire was used to collect baseline and follow-up data. Patients with incomplete medical records, multiple (>1) revision procedures, less than 3 weeks of postoperative follow-up data, or a history of Sjögren syndrome, severe thyroid eye disease, histoplasmosis ocular infection, periorbital trauma causing eyelid malposition, or radiotherapy for nasopharyngeal cancer were excluded from the study. Binary logistic regression analyses were performed to analyze the relationship between 13 preoperative and anatomical variables and DES or chemosis. χ² Tests were performed to analyze the relationship between intraoperative risk factors and DES or chemosis.

Results: In total, 892 cases met the study inclusion criteria. Dry eye symptoms and chemosis following blepharoplasty were reported in 26.5% and 26.3% of patients, respectively. The incidences of DES and chemosis were significantly higher in patients who underwent concurrent upper and lower blepharoplasty (P<.001) and in patients who underwent skin–muscle flap blepharoplasty (P=.001). Hormone therapy use and preoperative scleral show were associated with DES after blepharoplasty (P<.05). Male sex, preoperative eyelid laxity, and preoperative DES were associated with an increased incidence of chemosis following blepharoplasty (P<.05). Intraoperative canthopexy significantly increased the risk for developing chemosis (P=.009), and postoperative lagophthalmos significantly increased the risk for DES following blepharoplasty (P<.001).

Conclusions: Dry eye symptoms and chemosis are common following blepharoplasty, and the risk for developing these conditions may increase with intraoperative canthopexy, postoperative temporary lagophthalmos, concurrent upper and lower blepharoplasty, and transcutaneous approaches violating the orbicularis oculi muscle. Patients with a preoperative history of DES, eyelid laxity, scleral show, or hormone therapy use may be at greater risk for developing dry eyes or chemosis following surgery.


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Research findings have also suggested that the burden of DES is comparable with that of moderate angina. The pathogenesis of DES has been extensively studied. The normal tear film is a complex structure composed of an external lipid layer, aqueous layer, goblet cell mucous layer, and epithelial mucin layer (Table 1).

Dry eye symptoms have traditionally been thought to result from inadequate tear production (aqueous layer deficiency) or from unstable tear production (evaporative dry eye). Aqueous layer deficiency is caused by aging, autoimmune disease, medication adverse effects, or lacrimal gland disorders or obstruction. Evaporative dry eye is most commonly attributed to contact lens use or allergy, meibomian gland disease (blepharitis or rosacea), or disorders resulting in corneal exposure (thyroid eye disease or eyelid position abnormalities).

More recent evidence suggests a strong inflammatory component to the development of DED, and some ophthalmologists suggest characterization of DES by the term dysfunctional tear syndrome. Researchers have identified cytokines in the tear fluid of patients with keratoconjunctivitis sicca that seem to initiate an inflammatory cascade, resulting in direct damage to the corneal surface epithelium. Understanding the inflammatory component of DES has paved the way for the development of novel treatments, such as topical cyclosporine.

Despite our understanding of the tear film, most treatments for DES manage the chronicity of disease and are not considered curative. Although numerous investigations have assessed the burden of DES in the general population, researchers evaluating DES following blepharoplasty have observed low risk for the condition, ranging from 0% to 10.9%. The surgical literature commonly records DES as a minor or transient complication.

Chemosis following blepharoplasty has been more consistently reported in the surgical literature, with incidences ranging from 1% to approximately 12%. Postoperative lagophthalmos may lead to desiccation of the conjunctiva, which may cause fluid extravasation into the space between the conjunctiva and the sclera. The lymphatic system of the eyelids, which is formed along the tarsal borders and drains into the preauricular and submandibular nodes, can also be disrupted by skin–muscle flap elevation in lower eyelid blepharoplasty.

The objectives of this study were to examine outcomes among long-term blepharoplasty data to better understand the incidence of and risk factors associated with DES and chemosis. Known risk factors for DES in the general population were evaluated. Intraoperative procedures (such as forehead-lift, midface-lift, canthopexy, and canthoplasty) were also analyzed to determine their effects on DES and chemosis.

### METHODS

A 10-year retrospective medical record review (January 1999 through December 2009) was performed among all the consecutive cases of upper or lower blepharoplasty performed by one of us (S.W.P.) in his private facial plastic surgery practice. Patients with incomplete medical records, multiple (>1) revision procedures, less than 3 weeks of postoperative follow-up data, or a history of Sjögren syndrome, severe thyroid eye disease, histoplasmosis ocular infection, periorbital trauma causing eyelid malposition, or radiotherapy for nasopharyngeal cancer were excluded from the study.

For the past 20 years, the senior author (S.W.P.) has asked all the patients to fill out a dry eye questionnaire (Figure 1) at the initial visit and at approximately 2-year intervals, regardless of the reason for the visit. The questionnaire asks the following questions: (1) Are you bothered by frequent irritations or “al­lergies” of the eyes or eyelids? (2) Do you now take or have you ever taken medications or drops for the eyes? (3) Are you bothered by “dry eyes”? (4) Do your eyes “water” or tear spontaneously (without emotional stimulation)? In this study, patients with a positive response to question 3 or question 4, acknowledgment of regular use of lubricating drops, or physician-reported DES lasting longer than 4 weeks after surgery qualified as having DES. In all the cases, we were able to document baseline questionnaire results. Many patients also had subsequent questionnaires documented years after their blepharoplasties.

In addition to the questionnaires, medical records were reviewed for intraoperative details, preoperative and anatomical risk factors, and postoperative outcomes and management. These variables are summarized in Table 2.

Preoperative risk factors were analyzed. These included a history of allergy, cataract surgery, hypothyroidism, autoimmune disease, preoperative DES (as reported on the questionnaire), and refractive eye surgery (laser in situ keratomileusis, photorefractive keratectomy, or radial keratomatotomy), as well as multivitamin, antihistamine, antidepressant, or hormone therapy use.

The preoperative photographs were analyzed for several variables. These included (1) negative vector, defined as the most anterior projecting point of the cornea projecting beyond the orbital rim in profile view (Figure 2), (2) eyelid laxity by physician report in the consultation notes or subjective assessment by us of eyelid margin malposition relative to the globe (Figure 3), and (3) scleral show, defined as the eyelid margin inferior to the inferior limbus of the iris (Figure 4).

The operative reports were reviewed to record intraoperative details. These included the performance of revision blepharoplasty, upper blepharoplasty alone, lower blepharoplasty alone, or upper and lower blepharoplasty, as well as the type of lower blepharoplasty (skin–muscle flap, transconjunctival, or transcutaneous with skin pinch) and concurrent forehead-lift, midface-lift, canthopexy, canthoplasty, or placement of frost suture.

All the transconjunctival blepharoplasties were performed using a standard preseptal approach (Figure 5). All the skin–muscle flap blepharoplasties were performed with preserva-

### Table 1. Normal Tear Film

<table>
<thead>
<tr>
<th>Layer</th>
<th>Where Produced</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>External lipid</td>
<td>Meibomian glands</td>
<td>Stabilizes tear film, slows evaporation, lubricates eyelids over cornea</td>
</tr>
<tr>
<td>Aqueous</td>
<td>Lacrimal gland</td>
<td>Contains antibacterial substances, vitamin A, oxygen, growth factors, electrolytes</td>
</tr>
<tr>
<td>Inner mucin</td>
<td>Goblet cells</td>
<td>Facilitates tear film stabilization, combines with aqueous layer to reduce surface tension of tears</td>
</tr>
<tr>
<td>Epithelial mucin</td>
<td>Corneal epithelium</td>
<td>Anchors tear film to surface of cornea</td>
</tr>
</tbody>
</table>

*Adapted from O’Brien and Collum.*

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tion of a pretarsal orbicularis strip and orbicularis suspension suture (Figure 6), similar to the technique by Honrado and Pastorek.18

The clinical notes were reviewed for postoperative details. These included eyelid taping, eyelid massage, placement of punc-
tal plugs, DES and duration (in months), chemosis and dura-

Figure 1. Dry eye questionnaire used in the study.
tion (in days), canthoplasty for eyelid malposition, evidence of temporary lagophthalmos, corticosteroid injection into the eyelid, and the use of corticosteroid eyedrops or anti-inflammatory eyedrops. Chemosis was defined by conjunctival edema in the immediate postoperative period as reported in the clinical notes (Figure 7).

### RESULTS

In total, 892 cases met the study inclusion criteria. The population examined varied in age from 16 to 83 years, with a median and mean age of 53 years; 768 of 892 patients (86.1%) were female. Revision cases by the senior author (S.W.P.) and by outside surgeons were performed in 111 individuals (12.4%).

Overall, 563 patients (63.1%) underwent concurrent upper and lower blepharoplasty, 205 patients (23.0%) underwent lower blepharoplasty alone, and 124 patients (13.9%) underwent upper blepharoplasty alone.

### Table 2. Study Variables

<table>
<thead>
<tr>
<th>Preoperative Medical History</th>
<th>Patient Anatomy</th>
<th>Intraoperative Details</th>
<th>Postoperative Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Negative vector, eyelid laxity, scleral show</td>
<td>Upper blepharoplasty alone, lower blepharoplasty alone, concurrent upper and lower blepharoplasty, type of lower blepharoplasty, revision blepharoplasty, forehead-lift, midface-lift, canthoplasty, canthopexy, frost suture</td>
<td>Lagophthalmos, DES, chemosis, interventions for chemosis, interventions for DES</td>
</tr>
</tbody>
</table>

Abbreviation: DES, dry eye symptoms.
Of 768 patients undergoing lower blepharoplasty, 694 (90.4%) had a skin–muscle flap blepharoplasty, 39 (5.1%) had a transconjunctival approach, and 35 (4.6%) had a transconjunctival approach with skin pinch. A concurrent forehead-lift was performed in 238 patients (26.7%), and a concurrent midface-lift was performed in 72 patients (8.1%).

The percentage of patients who reported DES at some point following blepharoplasty was 26.5%. The interval from the time of surgery to the reporting of DES ranged from 1 to 132 months (mean, 26 months; median, 7 months).

The results of χ² tests revealed that DES were significantly more commonly reported following concurrent upper and lower blepharoplasty (31.3%) compared with upper blepharoplasty alone (12.9%) and lower blepharoplasty alone (21.4%) (χ² = 18.1; P < .001) (Figure 8). Dry eye symptoms were also significantly more commonly reported following skin–muscle flap blepharoplasty (29.0%) (odds ratio, 2.6; P < .001) compared with the transconjunctival approach (23.6%) and the transconjunctival approach with skin pinch (22.9%) (odds ratio, 2.2; P = .08) (Figure 9).

To determine if the likelihood of DES was owing to preoperative risk factors, we performed a binary logistic regression analysis (SPSS 19; SPSS Inc) with DES (yes or no) as the dependent variable and risk factors as the independent variables. The results of the regression analysis indicated that the presence of concurrent forehead-lift, concurrent midface-lift, and the use of skin–muscle flap blepharoplasty were significant risk factors for DES. However, the regression analysis did not reveal any significant interactions between these risk factors.

Figure 6. Skin–muscle flap blepharoplasty. A, Preservation of the pretarsal orbicularis oculi muscle. B, Placement of the orbicularis suspension suture.

Figure 7. Chemosis following blepharoplasty.

Figure 8. Dry eye symptoms (DES) and chemosis following blepharoplasty.

Figure 9. Dry eye symptoms (DES) and chemosis following lower eyelid blepharoplasty.
Concurrent midface-lift, forehead-lift, or canthopexy had no effect on the incidence of chemosis. However, intraoperative canthopexy was associated with a statistically significant increased risk for developing chemosis; 45.0% of patients who underwent canthopexy developed chemosis compared with 25.5% of patients who did not undergo canthopexy ($\chi^2 = 7.5, P = .009$).

Twenty-three years ago, the esteemed plastic surgeon Thomas D. Rees wrote: “For years we have struggled with the problem of dry eyes after blepharoplasty, especially as to how we can predict the complication as well as what to do about it when it occurs.”23(p577) He continued: “Temporary lagophthalmos can promote dryness to the cornea that can catalyze a chain of events resulting in a chronic dry eye problem.”23(p577)

Despite this, conventional teaching in facial plastic surgery has been that DES and chemosis are minor problems following blepharoplasty. It has also been thought that temporary lagophthalmos following surgery does not create long-term problems and should be advocated.

Our study found that more than one-quarter of patients reported DES or experienced chemosis following blepharoplasty. As Rees observed decades earlier, lagophthalmos can lead to chronic DES. We observed herein that patients with postoperative temporary lagophthalmos were significantly more likely to report DES following blepharoplasty (41.3% of patients with lagophthalmos vs 22.9% of patients without lagophthalmos, $P < .001$). Similarly, we found that DES and chemosis were significantly more common in patients who underwent concurrent upper and lower blepharoplasty. Although all the cases of chemosis eventually resolved, DES often represented a chronic problem that was reported long after surgery (mean, 26 months).

### Table 3. Analysis of Preoperative Risk Factors Associated With Dry Eye Symptoms (DES)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>$\beta$ (SE)</th>
<th>$\text{Exp}(\beta)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>0.255 (0.234)</td>
<td>1.291</td>
</tr>
<tr>
<td>Autoimmune disease</td>
<td>0.692 (0.523)</td>
<td>1.999</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>0.187 (0.239)</td>
<td>1.206</td>
</tr>
<tr>
<td>Refractive eye surgery</td>
<td>0.038 (0.295)</td>
<td>1.039</td>
</tr>
<tr>
<td>Cataract surgery</td>
<td>0.236 (0.441)</td>
<td>1.266</td>
</tr>
<tr>
<td>Antidepressive use</td>
<td>-0.080 (0.204)</td>
<td>0.923</td>
</tr>
<tr>
<td>Hormone therapy use</td>
<td>0.364 (0.178)</td>
<td>1.439</td>
</tr>
<tr>
<td>Preoperative DES</td>
<td>0.301 (0.163)</td>
<td>1.351</td>
</tr>
<tr>
<td>History of allergy</td>
<td>0.160 (0.227)</td>
<td>1.173</td>
</tr>
<tr>
<td>Antihistamine use</td>
<td>-0.009 (0.411)</td>
<td>0.991</td>
</tr>
<tr>
<td>Multivitamin use</td>
<td>0.280 (0.157)</td>
<td>1.323</td>
</tr>
<tr>
<td>Negative vector</td>
<td>-0.150 (0.250)</td>
<td>0.861</td>
</tr>
<tr>
<td>Eyelid laxity</td>
<td>-0.053 (0.291)</td>
<td>0.949</td>
</tr>
<tr>
<td>Scleral show</td>
<td>0.918 (0.389)</td>
<td>2.504</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.468 (0.150)</td>
<td>0.230</td>
</tr>
</tbody>
</table>

$a P < .05$.  
$b P < .10$.  
$c P < .01$.  

### Table 4. Analysis of Preoperative Risk Factors Associated With Chemosis

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>$\beta$ (SE)</th>
<th>$\text{Exp}(\beta)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>0.529 (0.223)</td>
<td>1.697</td>
</tr>
<tr>
<td>Autoimmune disease</td>
<td>-0.403 (0.656)</td>
<td>0.668</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>0.141 (0.244)</td>
<td>1.151</td>
</tr>
<tr>
<td>Refractive eye surgery</td>
<td>-0.166 (0.301)</td>
<td>0.847</td>
</tr>
<tr>
<td>Cataract surgery</td>
<td>0.022 (0.456)</td>
<td>1.022</td>
</tr>
<tr>
<td>Antidepressive use</td>
<td>0.034 (0.203)</td>
<td>1.035</td>
</tr>
<tr>
<td>Hormone therapy use</td>
<td>0.045 (0.184)</td>
<td>1.047</td>
</tr>
<tr>
<td>Preoperative DES</td>
<td>0.483 (0.163)</td>
<td>1.620</td>
</tr>
<tr>
<td>History of allergy</td>
<td>0.083 (0.235)</td>
<td>1.087</td>
</tr>
<tr>
<td>Antihistamine use</td>
<td>0.488 (0.386)</td>
<td>1.629</td>
</tr>
<tr>
<td>Multivitamin use</td>
<td>0.269 (0.158)</td>
<td>1.309</td>
</tr>
<tr>
<td>Negative vector</td>
<td>0.204 (0.239)</td>
<td>1.226</td>
</tr>
<tr>
<td>Eyelid laxity</td>
<td>0.620 (0.270)</td>
<td>1.859</td>
</tr>
<tr>
<td>Scleral show</td>
<td>-0.377 (0.449)</td>
<td>0.686</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.525 (0.152)</td>
<td>0.218</td>
</tr>
</tbody>
</table>

Abbreviation: DES, dry eye symptoms.  
$a P < .05$.  
$b P < .01$.  
$c P < .10$.  

does) as the binary dependent variable. The following predictor variables were also used: eyelid laxity, scleral show, and negative vector; a history of allergy, cataract surgery, hypothyroidism, preoperative DES, autoimmune disease, or refractive eye surgery; and multivitamin, antihistamine, antidepressant, or hormone therapy use.

Among the risk factors studied, hormone therapy ($P = .04$) use and preoperative scleral show had a statistically significant effect on DES ($P < .05$). Preoperative DES and multivitamin use approached statistical significance ($P = .08$) (Table 3).

Postoperative chemosis seemed to affect the likelihood of temporary DES following blepharoplasty ($\chi^2 = 18.3, P < .001$). However, chemosis did not seem to affect the long-term (>12-month) risk for DES ($\chi^2 = 0.4, P = .4$). Concurrent midface-lift, forehead-lift, or canthopexy had no positive or negative correlation with DES. However, postoperative lagophthalmos was associated with a statistically significant increased risk for DES; 41.3% of patients who had postoperative lagophthalmos reported DES compared with 22.9% of patients who did not have lagophthalmos immediately following blepharoplasty ($\chi^2 = 24.1, P < .001$).

The percentage of patients with chemosis following blepharoplasty was 26.3%. All the cases eventually resolved during a range of 1 to 180 days (mean, 26 days; median, 14 days).

Chemosis was significantly more common in patients having concurrent upper and lower blepharoplasty (35.3%) compared with patients having upper blepharoplasty alone (0.8%) or lower blepharoplasty alone (15.6%) ($\chi^2 = 63.7, P < .001$) (Figure 8). Chemosis was also significantly more common in patients undergoing skin–muscle flap blepharoplasty (34.3%) compared with the transconjunctival approach (5.1%) or the transconjunctival approach with skin pinch (20.0%) ($P = .001$) (Figure 9).

Logistic regression analyses revealed an association between chemosis and male sex, preoperative DES, and preoperative eyelid laxity ($P < .05$). These results are summarized in Table 4.
Dry eye symptoms were significantly more commonly reported following skin–muscle flap blepharoplasty (occurring in 29.0%) compared with the transconjunctival approach (25.6%) and the transconjunctival approach with skin pinch (22.9%) \( (P < .01) \). It is possible that the alteration of blink forces with a transcutaneous approach is an initiating event for DES.

Despite the significance of our findings, this study cannot attribute causation of DES to blepharoplasty. The study did not control for DES risk factors after blepharoplasty, such as new medication use and refractive or cataract surgery.

Our findings complement other investigations suggesting that all patients undergoing blepharoplasty should have a preoperative risk factor assessment for chemosis, looking for scleral show, lagophthalmos, negative vector, previous surgery, positive snap test result, and dryness, grittiness, and pain. \(^24\) Our results indicate that this assessment should also include the variables of male sex, preoperative DES, and preoperative eyelid laxity.

The routine use of canthal support during skin–muscle flap blepharoplasty has recently gained momentum. \(^25\) Our study found that canthopexy significantly increased the risk for chemosis following blepharoplasty (occurring in 45.0% with canthopexy vs 25.5% without canthopexy, \( P = .009 \)). It is possible that placement of the canthopexy suture obliterated or compromised the lymphatic plexus exiting at the lateral aspect of the tarsus. This vulnerability was potentially worsened by the violation of the orbicularis and septum during transcutaneous blepharoplasty. It is also possible that the use of a dissolvable canthopexy suture was not an effective technique for patients at risk for postoperative chemosis. In other words, some of the patients who received a canthopexy would have been better served with a more aggressive technique, such as a canthoplasty.

Our study may be limited by the underestimation of DES incidence. We defined dry eye by subjective symptoms rather than objective signs, such as interpalpebral surface damage, tear instability, or tear hyperosmolarity. \(^13\) It is possible that an ophthalmologic examination would have identified patients having objective findings consistent with DES, similar to the prevalence study by Trattler et al. \(^9\)

We also found that many patients reported DES only on questionnaires following blepharoplasty. All the patients in this study had baseline preoperative dry eye questionnaires; however, some medical records did not contain postoperative questionnaires. Our study findings complement the assertion that patients may not report DES unless specifically queried about the symptoms.

As a retrospective investigation, our study was limited by the data that had already been reported in intake sheets, progress notes, operative reports, and photographs. By relying on existing data, we may have missed some cases of eyelid laxity, scleral show, and postoperative DES, chemosis, or lagophthalmos. In addition, recall bias may have affected preoperative risk factor assessment and postoperative DES questionnaires because patients completed the latter at least 1 year after surgery.

The senior author (S.W.P.) favors transcutaneous approaches for lower eyelid blepharoplasty, with 90.4% of the patients herein having undergone a skin–muscle flap approach. This procedural bias could have affected our outcomes. Despite these limitations, to our knowledge, this is the first and most comprehensive study to analyze preoperative, intraoperative, and postoperative factors and their relationship to DES and chemosis following upper and lower blepharoplasty.

CONCLUSIONS

Dry eye symptoms and chemosis are more common following blepharoplasty than previously reported. The risk for developing these conditions may increase with concurrent upper and lower blepharoplasty and transcutaneous approaches violating the orbicularis oculi muscle, as well as with intraoperative canthopexy and postoperative lagophthalmos. Male sex, hormone therapy use, and preoperative DES, eyelid laxity, and scleral show may be predictors of DES or chemosis following blepharoplasty.

Although considered by some to be a temporary problem, DES and chemosis are underestimated and often do not remit with time. Dry eye symptoms and chemosis should be considered possible sequelae following blepharoplasty, and appropriate preoperative counseling and informed consent should be mandated.

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Author Contributions: Drs Prischmann and Ruffin had full access to the data in this study and take full responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Prischmann and Perkins. Acquisition of data: Prischmann, Sufyan, and Ting. Analysis and interpretation of data: Prischmann, Ting, and Ruffin. Drafting of the manuscript: Prischmann and Sufyan. Critical revision of the manuscript for important intellectual content: Prischmann, Ting, Ruffin, and Perkins. Statistical analysis: Prischmann, Sufyan, and Ruffin. Administrative, technical, and material support: Prischmann and Ting. Study supervision: Prischmann and Perkins.
Conflict of Interest Disclosures: None reported.
Additional Contributions: Derek Houston, PhD, guided the statistical analysis of the study, Melissa Mumaw and Karla McConnell retrieved medical records for the study, and Christopher Brown, BFA, MS, and Nancy Rothrock, MFA, assisted with illustrations and photographs. Figure 5 has been adapted with permission from Indiana University School of Medicine, Indianapolis, Office of Visual Media.

REFERENCES