ONLINE FIRST

Cataracts in Atopic Dermatitis

A Case Presentation and Review of the Literature

Brooke Bair, DO; John Dodd, DO; Karen Heidelberg, MD; Kent Krach, MD

Background: Atopic dermatitis (AD) is a common skin disorder of increasing prevalence. Many ophthalmologic conditions are associated with AD, including cataract formation. Posterior and anterior subcapsular cataracts have been described in AD. Topical and systemic corticosteroids have been implicated in the development of cataracts. The precise pathogenic mechanisms and risk factors for development of atopic cataract are not clear.

Observation: We report a case of cataract development in a child with severe AD and performed an extensive review of the dermatologic and ophthalmologic literature pertaining to AD and cataract formation. The incidence, demographics, pathogenesis, and characteristics of atopic cataracts are evaluated.

Conclusions: Atopic dermatitis alone is a risk factor to develop both posterior and anterior subcapsular cataracts. There is a slightly increased probability of posterior subcapsular cataracts. However, anterior subcapsular cataracts are more specific to AD. A positive correlation was found between atopic cataract development and a decreased inducibility of superoxide dismutase. This suggests that atopic cataract development is correlated with oxidative damage of the lens and related to chronic inflammation.

Arch Dermatol. 2011;147(5):585-588.
Published online January 17, 2011.
doi:10.1001/archdermatol.2010.411

ATOPIC DERMATITIS (AD) IS a common form of chronic eczematous dermatitis, often part of the "atopic triad" including asthma and allergic rhinitis. Atopic dermatitis typically begins in infancy or childhood and can continue on a waxing-waning course into adulthood. Pathogenesis of AD is predominantly a T-helper cell type 2–dominant immune phenomenon, and recent research has revealed an association with mutations in filaggrin.[1,2]

See Practice Gaps at end of article

Ocular sequelae are commonly seen in AD and include subcapsular cataracts, herpes simplex, conjunctivitis, keratoconus, and retinal detachment.[2] Posterior and anterior subcapsular cataracts have been described in AD, with conflicts in the existing literature as to which is more common overall. Distinguishing which cataract location is more common in the AD population may help to clarify pathogenic risk factors and potentially help decrease their incidence.

A cataract is an opacity of the normally clear lens, which may develop as a result of aging, metabolic disorders, trauma, or heredity. Effect on visual acuity depends on the location of the cataract within the lens. The types of cataracts seen in patients with AD are in subcapsular region, either anterior subcapsular cataracts (ASCs) or posterior subcapsular cataracts (PSCs). Cataracts can develop in the cortex of the lens, and these are structurally different than ASCs and PSCs seen with AD.[3]

REPORT OF A CASE

A 6-year-old African American girl presented with an uncontrolled flare of AD. Her medical history was significant for asthma and allergic rhinitis with a family history of AD. Her asthma was controlled with daily use of a combination fluticasone-salmeterol inhaler. She admits to using the inhaler properly, with delivery of aerosolized medication into the airway. Her history of severe and uncontrolled disease led to frequent severe exacerbations, and she averaged 10 hospitalizations per year and numerous missed school days. These admissions resulted in repeated courses of topical and systemic corticosteroids and emollients and antibiotics.

Author Affiliations: St Joseph Mercy Hospital, Ann Arbor, Michigan (Drs Bair, Dodd, Heidelberg, and Krach); and Departments of Dermatology (Drs Bair, Heidelberg, and Krach) and Ophthalmology (Dr Dodd), St John's Providence Health System, Oakland Hospital, Madison Heights, Michigan.

On initial presentation she was restless and irritable with a generalized eruption of confluent, erythematous, and hyperpigmented, weepy, and lichenified plaques. She was initially started on a regimen of midpotency topical corticosteroids, antihistamines, citrus-limited diet, and bathing restrictions (decreased water temperature and bath duration of 7 minutes or less). Topical corticosteroids on the face were restricted to class 6 or lower, 1 to 2 times per day. She improved minimally with these measures, and a trial of UV-B 3 times weekly was started. After a lack of improvement, she was switched to UV-A 3 times weekly. Her pruritus improved with maintenance of UV-A phototherapy, topical corticosteroids, and antihistamines. Proper eye protection was used during phototherapy treatments. She was started on long-term trimethoprim-sulfamethoxazole therapy by an infectious disease specialist for recurrent methicillin-resistant *Staphylococcus aureus* skin infections.

Approximately 1 year later, the patient awoke and complained that she was "blind." She was emergently evaluated by an ophthalmologist and was found to have bilateral anterior subcapsular cataracts, which were corrected surgically. Four weeks after surgical correction of cataracts, she developed a detached retina of the right eye.

COMMENT

The incidence of AD is on the rise with the highest prevalence affecting industrialized countries. In more than two-thirds of the cataract cases in AD, a family history of eczema, asthma or hay fever, and infantile onset of eczema was noted. The incidence for cataract development in patients with AD has been reported from 5% to 38%.[4] The population of those with cataracts formation showed no sexual predilection, with the age at onset ranging from adolescence into adulthood. The development of atopic cataracts in children younger than 10 years (as in our case report) is rare.[5,6]

A Mayo Clinic study noted that "dermatitis" preceded the development of cataracts by years. In this study, the majority (58%; 79 cases) of the AD patients with cataracts had visual impairment, but 42% (57 cases) of those found to have cataracts by slit-lamp examination had no significant visual impairment.[7] The majority of cases had bilateral involvement, which is still uniform across the literature.[4,5,7] Unfortunately, this particular study failed to report the location (anterior vs posterior) of the cataracts within the lens.

The literature reporting anterior vs posterior cataract development in patients with AD contains conflicting data. The onset of ASC is typically rapid, shieldlike bilateral visual impairment.[5,6] It is likely that this presentation of ASC has become known as the "classic" cataract presentation in AD because ASC in the absence of AD is not common.[8] However, the largest studies using slit-lamp examination found posterior subcapsular cataract to be more common overall in patients with AD.[6,9-11]

PATHOGENESIS

Postulated pathogenic mechanisms for cataracts in patients with AD include the following:

- Clinical severity of AD
- Oxidative stress by free radicals
- Corticosteroid therapy
- Elevated IgE level
- Filaggrin mutation
- Phototherapy.

Clinical Severity

The precise pathogenic mechanisms for the development of cataracts in patients with AD remain elusive. It has been postulated by many that cataract development in atopic patients is directly related to facial involvement leading to repetitive trauma secondary to rubbing and scratching of the eye.[5,6] This is precisely the reasoning behind the hypothesis that cataract development is related to "severe" AD; however, there is more data to refute this theory than support it. Most authors found that the presence of cataracts (both ASC and PSC) was *not* related to the onset, severity, or duration of AD.[8,12] In addition, the clinical features of the patients with AD who developed cataracts were no different than those who did not. Importantly, the development of cataracts was seen in some with only mild facial involvement.[12,13]

Oxidative Stress

Consumption of antioxidants, retinal peroxidation, and increasing production of free radicals have been proposed as pathogenic mechanisms in human cataractogenesis.[5,10,14,15] These pathogenic factors have been more strongly related to age-related and cortical cataract formation,[14] but some authors have proposed their role in AD patients with cataracts. There have been theories relating ASC formation with increased inflammatory markers, such as interleukin 6 (IL-6), tumor necrosis factor,[16] and transforming growth factor β.[17]

Lipid peroxidation refers to the oxidative degradation of lipids. In this process, reactive oxygen species (free radicals) damage the lipids in cell membranes resulting in cell damage. Superoxide dismutase is an enzyme that inhibits the formation of these free radicals.[10]

Niwa et al[10] compared a group of AD patients with cataracts to AD patients without cataracts, examining some of the aforementioned parameters. The findings showed that serum lipid peroxide levels were increased, and superoxide dismutase activity was markedly less inducible in patients with both AD and cataracts. These results correlate the decreased inducibility of superoxide dismutase (decreased inhibition of free radical formation) to increased cataract formation in patients with AD. Importantly, these findings were not observed in patients with other forms of dermatitis (eg, psoriasis) who had been receiving prolonged topical corticosteroid therapy.[10,15]

Corticosteroid Therapy

Systemic corticosteroids are known to cause a wide range of ocular complications. The relationship between systemic corticosteroid use and the development cataracts was first reported in 1960. The incidence of cataract formation is dose and treatment duration dependent. Those at greatest risk appear to be those receiving the equivalent of prednisone, 10 to 15 mg/d for at least 1 year.[18] The cataracts related to systemic corticosteroid use were usually bilateral and posterior subcapsular.[11,18]

Corticosteroid-related cataracts do not commonly develop in children. Posterior subcapsular cataracts have been reported in pediatric patients receiving inhaled (not intranasal) corticosteroids.[18] These reports are thought to be related to improper use of inhalers, resulting in direct ocular exposure.

Cataracts in AD were first described in 1914; however, topical corticosteroids were not introduced into the practice of medicine until the 1950s.[7] Therefore, cataract development in patients with AD was recognized long before topical corticosteroids were introduced into the practice of medicine.

A 1994 study compared 3 groups of patients with AD—those treated with topical corticosteroids, those treated with both topical and systemic corticosteroids, and corticosteroid-naive patients. This study showed no difference in incidence percentage of cataract development between the groups. In the 37 patients who developed cataracts, 86% had posterior cataract.[10]

Elevated IgE Level and Genetics

Elevated IgE levels are known to be associated with the coexisting respiratory disease, increased severity of skin involvement, and the development of keratoconus.[1] Studies evaluating IgE levels have not shown a correlation between elevated IgE levels and development of cataracts in patients with AD.[5,10] To our knowledge, there have not been any studies evaluating filaggrin mutations cataract formation in patients with AD.

Phototherapy

Phototherapy is used in the treatment of many skin disorders and has been an important corticosteroid-sparing therapy for severe AD. The newer narrowband UV-B and UV-A1 are considered the most efficacious regimens for treating acute and chronic AD.[19,20] Exposure of the unprotected eye to psoralen plus UV-A (PUVA) therapy has been shown to induce cortical lens opacities.[19] Cortical cataracts are structurally different than anterior or posterior subcapsular cataracts seen with AD and are strongly associated with UV radiation.[3] Therefore, eye protection is an important safety precaution in anyone receiving phototherapy.

TREATMENT OF CATARACTS

Surgical correction of lenticular opacities should be performed if the opacities result in visual impairment. An increased rate of retinal detachment has been reported in AD patients with cataracts who undergo surgical correction; however, retinal detachment is not exclusively a postsurgical phenomenon.[21,22]

LIMITATIONS

The data presented are based on a review of the literature, and therein rest inherent discrepancies between authors, including terms related to severity of AD. The majority of these studies did not use an objective measure like the SCORAD index.[23] The data presented from the Mayo Clinic study with a 1158 patient cohort did not include outpatients, patients with only mild facial involvement, infants, or young children.[7] Therefore, this may have underrepresented the true population of those with cataract formation leading to bias in discovery of cataract cases. Most of the literature is from cross-sectional studies performed over 20 years ago, with some patients being older than 50 years. There is an inherent selection bias. Patients without visual complaints usually do not visit an ophthalmologist; therefore, visually insignificant cataract may be underreported.

CONCLUSIONS

Atopic dermatitis alone is a risk factor to develop both PSCs and ASCs; ASC are more specific to AD, but PSCs are more common. Cataracts involving the posterior subcapsular region are known to be associated with systemic corticosteroid use in those with and without AD. It is an interesting finding in the existing literature that the incidence of cataract in AD corticosteroid-naive patients was no different when compared with the patients with a history of topical and systemic corticosteroid use. This strongly implies that the incidence of PSC formation in patients with AD cannot be explained by the use of corticosteroids alone.

There was a positive correlation between cataract development in AD and decreased inducibility of superoxide dismutase. This would allow for oxidative damage of the lens by free radicals. This increase in inflammatory mediators and free radicals may represent an independent risk factor for the development of cataract in AD either inherent in genotype or the chronic inflammatory nature of the condition.

Although some of the literature to date suggests that clinical severity does not correlate with the onset of cataracts in AD, there is conflicting data to suggest that it does. The majority of patients with atopic cataracts have noted infantile onset, leading to a longer duration of this relapsing-remitting inflammatory disease.

Further prospective studies would be helpful to further define these associated conditions. Atopic dermatitis is a chronic disease that my spill inflammatory mediators into the eye and crystalline lens. A closer examination of superoxide dismutase activity, measurement of serum lipid peroxides, measurement of aqueous lipid peroxides and other inflammatory mediators at the time of cataract presentation may prove to be valuable in elucidating a causal relationship between AD and cataract formation. These studies should also evaluate dis-

ease severity with specific parameters (eg, SCORAD index) before drawing a conclusion that severity does not affect cataract development.

Dermatologists who care for pediatric and adolescent patients with AD should refer these patients to be evaluated and followed by an ophthalmologist. The risk factors for the development of PSC include the following:

- Infantile onset of AD
- Family history of AD, asthma, or hay fever
- Systemic corticosteroid use
- Elevated lipid peroxide levels.

Use of systemic corticosteroids in children with AD is not recommended for routine care owing to the increased risk of PSC development (as well as other systemic adverse effects) and the chronic nature of the condition.

Accepted for Publication: November 1, 2010.
Published Online: January 17, 2011. doi:10.1001/archdermatol.2010.411
Correspondence: Brooke Bair, DO, 481 S Roscoe Blvd, Ext Ponte Vedra Beach, FL 32082 (brookebair@gmail.com).
Author Contributions: All authors had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Bair, Dodd, Heidelberg, and Krach. *Acquisition of data:* Bair, Dodd, and Heidelberg. *Analysis and interpretation of data:* Bair, Heidelberg, and Krach. *Drafting of the manuscript:* Bair. *Critical revision of the manuscript for important intellectual content:* Bair, Dodd, Heidelberg, and Krach. *Study supervision:* Dodd, Heidelberg, and Krach.
Financial Disclosure: None reported.

REFERENCES

1. van den Oord RA, Sheikh A. Filaggrin gene defects and risk of developing allergic sensitisation and allergic disorders: systematic review and meta-analysis. *BMJ*. 2009;339:b2433.
2. Carmi E, Defossez-Tribout C, Ganry O, et al. Ocular complications of atopic dermatitis in children. *Acta Derm Venereol*. 2006;86(6):515-517.
3. Richer SP, Yonatan E, Harper CK, McNelis M, Rudy DR, Perdue A. A clinical review of non-age-related cataracts. *Optometry*. 2001;72(12):767-778.
4. Chen CC, Huang JL, Yang KD, Chen HJ. Atopic cataracts in a child with atopic dermatitis: a case report and review of the literature. *Asian Pac J Allergy Immunol*. 2000;18(1):69-71.
5. Rich LF, Hanifin JM. Ocular complications of atopic dermatitis and other eczemas. *Int Ophthalmol Clin*. 1985;25(1):61-76.
6. Thompson RG. Cataract with atopic dermatitis: dermatologic aspects, with special reference to preoperative and postoperative care. *Arch Derm Syphilol*. 1950; 61(3):433-441.
7. Brunsting LA, Reed WB, Bair HL. Additional report on the occurrence of cataracts with atopic dermatitis. *AMA Arch Derm*. 1957;76(6):779.
8. Donshik PC, Hoss DM, Ehlers WH. Inflammatory and papulosquamous disorders of the skin and eye. *Dermatol Clin*. 1992;10(3):533-547.
9. Amemiya T, Matsuda H, Uehara M. Ocular findings in atopic dermatitis with special reference to the clinical features of atopic cataract. *Ophthalmologica*. 1980; 180(3):129-132.
10. Niwa Y, Iizawa O. Abnormalities in serum lipids and leukocyte superoxide dismutase and associated cataract formation in patients with atopic dermatitis. *Arch Dermatol*. 1994;130(11):1387-1392.
11. Castrow FF II. Atopic cataracts versus steroid cataracts. *J Am Acad Dermatol*. 1981;5(1):64-66.
12. Brandonisio TM, Bachman JA, Sears JM. Atopic dermatitis: a case report and current clinical review of systemic and ocular manifestations. *Optometry*. 2001; 72(2):94-102.
13. Garrity JA, Liesegang TJ. Ocular complications of atopic dermatitis. *Can J Ophthalmol*. 1984;19(1):21-24.
14. Micelli-Ferrari T, Vendemiale G, Grattagliano I, et al. Role of lipid peroxidation in the pathogenesis of myopic and senile cataract. *Br J Ophthalmol*. 1996;80(9): 840-843.
15. Namazi MR, Handjani F, Amirahmadi M. Increased oxidative activity from hydrogen peroxide may be the cause of the predisposition to cataracts among patients with atopic dermatitis. *Med Hypotheses*. 2006;66(4):863-864.
16. Klein BE, Klein R, Lee KE, Knudtson MD, Tsai MY. Markers of inflammation, vascular endothelial dysfunction, and age-related cataract. *Am J Ophthalmol*. 2006; 141(1):116-122.
17. Ishida I, Saika S, Okada Y, Ohnishi Y. Growth factor deposition in anterior subcapsular cataract. *J Cataract Refract Surg*. 2005;31(6):1219-1225.
18. Renfro L, Snow JS. Ocular effects of topical and systemic steroids. *Dermatol Clin*. 1992;10(3):505-512.
19. Meduri NB, Vandergriff T, Rasmussen H, Jacobe H. Phototherapy in the management of atopic dermatitis: a systematic review. *Photodermatol Photoimmunol Photomed*. 2007;23(4):106-112.
20. Gambichler T. Management of atopic dermatitis using photo(chemo)therapy. *Arch Dermatol Res*. 2009;301(3):197-203.
21. Katsura H, Hida T. Atopic dermatitis: retinal detachment associated with atopic dermatitis. *Retina*. 1984;4(3):148-151.
22. Hida T, Tano Y, Okinami S, Ogino N, Inoue M. Multicenter retrospective study of retinal detachment associated with atopic dermatitis. *Jpn J Ophthalmol*. 2000; 44(4):407-418.
23. European Task Force on Atopic Dermatitis. Severity scoring of atopic dermatitis: the SCORAD index: consensus report of the European Task Force on Atopic Dermatitis. *Dermatology*. 1993;186:23-31.

PRACTICE GAPS

Screening for Ocular Complications in Atopic Dermatitis

Many dermatologists are aware of some association between the use of systemic or periocular topical corticosteroids (CSs) and glaucoma and cataracts. However, few are aware of the occurrence of atopic dermatitis (AD) and cataracts unrelated to treatment. Regular ophthalmological examination is not part of the routine dermatologic care of chronic AD for most patients. This practice gap reflects several factors. First, there are not good data on the prevalence of these complications. Second, most cataracts and glaucoma cases are asymptomatic and cannot be readily detected by dermatologists. Third, few dermatologists proactively inquire about visual complaints in their review of systems. And fourth, most dermatologists do not regularly interface with ophthalmologists in the care of their patients with AD, nor are they familiar with the ophthalmology literature.

Corticosteroids have been associated with posterior subcapsular cataracts, while AD has been associated with