Principles and Practice of Clinical Electrophysiology of Vision

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98

X-Linked Juvenile Retinoschisis

John R. Heckenlively

X-linked juvenile retinoschisis is a bilateral congenital disorder that is characterized by a splitting of the retinal nerve fiber layer, and in virtually every case distinctive multiple lobular cysts are present in the macula from early childhood (Fig 98–1,A and B). Not all patients will have alterations from schisis in areas outside the macula, although mottling and an unusual sheen appearance may be found in many patients who may not be showing overt schisis (Fig 98–2,A and B). In affected males, areas of the retina will show partial- or full-thickness holes of varying size, and the inner retinal layer may be peeled back and floating in the vitreous above the retina (Fig 98–3,A and B). A structural defect in Müller cells has been suggested as the basis for the retinal abnormalities.[3] Patients with X-linked retinoschisis may progress to severe night blindness.[6]

X-linked retinoschisis has a characteristic electroretinographic (ERG) pattern; when recorded in children and young adults by using a standard protocol as noted elsewhere in this text, the ERG has the following typical changes: the photopic waveform is normal to half-normal, the rod-mediated tracing is subnormal to half-normal, while the dark-adapted bright-flash ERG has a negative waveform (Fig 98–4). The characteristic negative ERG along with the macular schisis typical of this condition easily gives the diagnosis. Advanced cases, particularly if a pigmentary retinopathy is present, may have poor to nonrecordable ERGs and may be misdiagnosed as retinitis pigmentosa unless other younger family members are available for examination.

The two most common presentations in children are from school referrals because of subnormal visual acuity and from episodes of vitreous hemorrhage caused by the ripping of peripheral retinal vessels, presumably at times when an area of schisis tears or ruptures. The most common site of schisis is the inferotemporal area of the retina.[2, 10]

The process appears to be most active from childhood to adolescent years when areas of schisis will appear, often as schisis cavities that break and leave fragmented edges that may be elevated into the vitreous or that curl up on itself at the edge of a partial-thickness retinal hole (see Fig 98–3,A and B). An occasional patient will develop a retinal detachment from a full-thickness hole or from communication of an inner and outer hole, and this needs to be corrected with traditional methods of scleral buckle or vitrectomy, laser, or internal tamponade.[1, 9] If the patient has recurrent bleeding from an elevated vessel, laser may be used to close the vessel at the point where the retina is still in contact with the retinal pigment epithelium.

Some adult patients will develop a pigmentary retinopathy as a response to the generalized retinal degeneration that may occur in some patients.[5, 11] The macular stellate schisis pattern occurs in virtually all cases, although rare cases are occasionally seen with juvenile retinoschisis and no evidence of macular schisis (the author has seen two examples). The macular schisis is usually lost as a diagnostic sign in older individuals since the tissue degenerates and atrophies. When present, the macular schisis

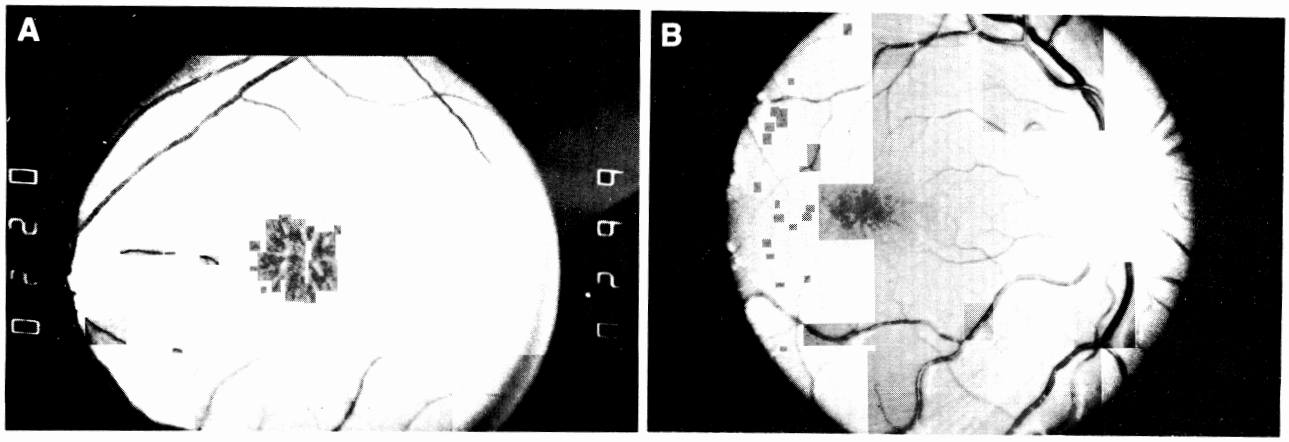

FIG 98–1.
Macular schisis in a 12-year-old boy with X-linked juvenile retinoschisis demonstrated by red-free photography **(A)** and an 8-year-old boy on color fundus photographs **(B).** The visual acuities were 20/100 and 20/70, respectively.

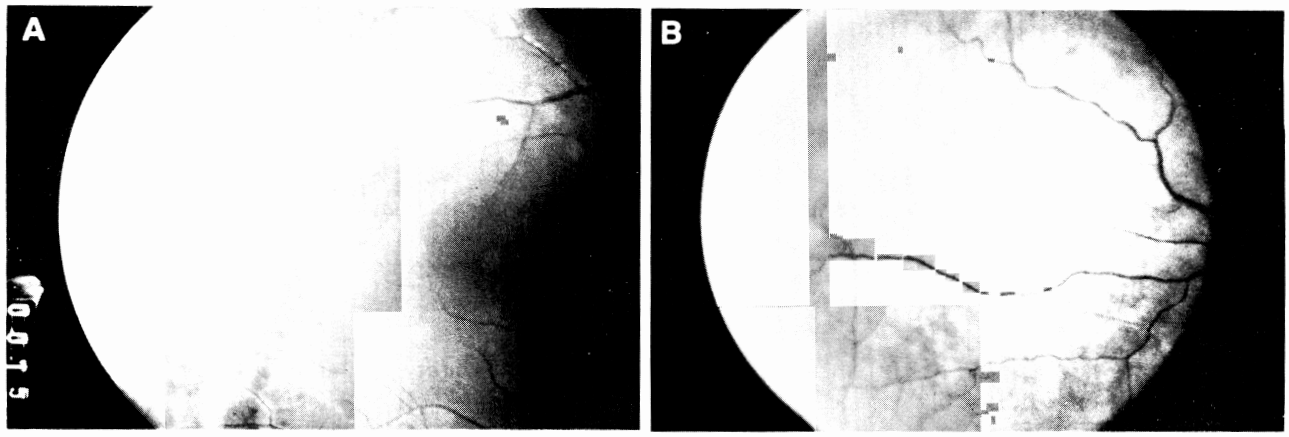

FIG 98–2.
Reticular peripheral retinoschisis in a 7-year-old boy who presented with a minor vitreal hemorrhage **(A)** and a 56-year-old man with an affected maternal grandfather who has had poor vision from childhood **(B).**

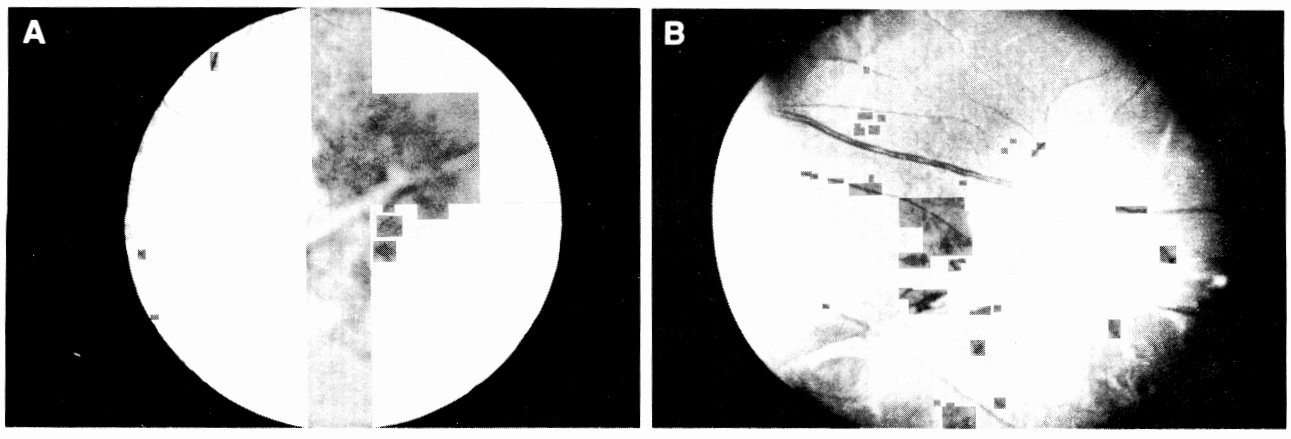

FIG 98–3.
Juvenile X-linked retinoschisis. **A,** splitting and consolidation of a nerve fiber layer leave a denuded retinal area in an 11-year-old boy. **B,** a 13-year-old black male who also showed some scarring at the schisis site as well as vitreous veils.

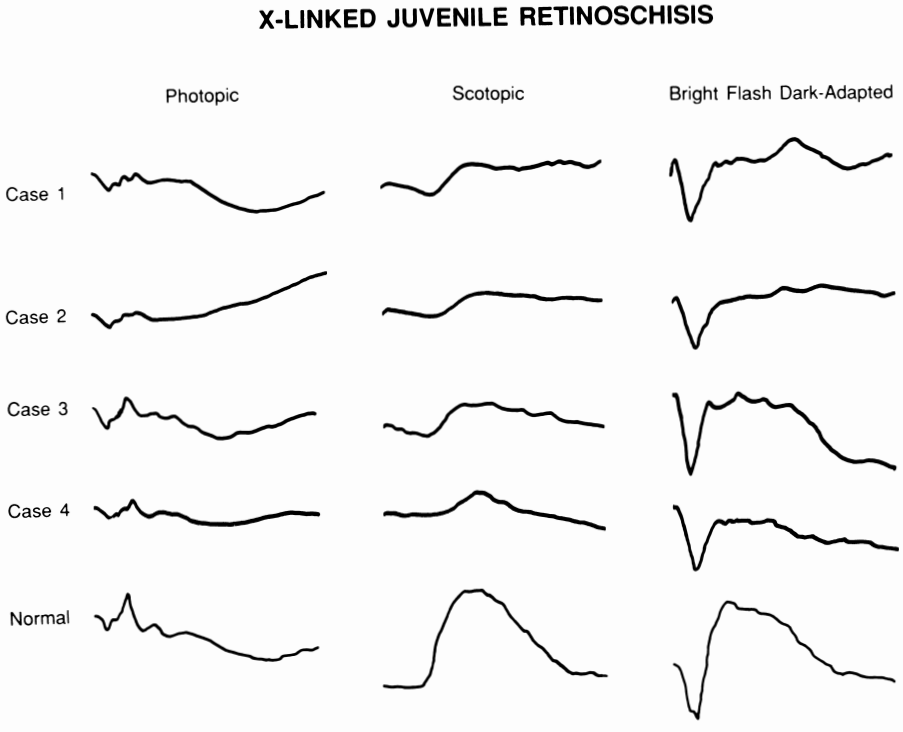

FIG 98–4.
ERG tracings from four representative patients with X-linked juvenile retinoschisis and a normal control subject. The ERG results of the photopic, scotopic rod-isolated, and dark-adapted bright-flash conditions are shown. Patients with X-linked retinoschisis typically have a "negative" waveform under dark-adapted bright-flash conditions and have attenuated photopic and scotopic responses. These tracings correlate with the values in Table 98–1.

may be seen most easily with red-free photography (see Fig 96–1,A), and the cystlike spaces do not leak or show dye accumulation.

The presence of the negative waveform with loss of b-wave amplitude is suggestive of a midretinal layer lesion, and the known bridging of the inner and outer retina by the Müller cell would make it a strong candidate as the cellular site of the disease.[8] Histopathological studies generally demonstrate a splitting within the nerve fiber layer that may extend anteriorly to the ora serrata. Yanoff et al. suggested that X-linked retinoschisis may arise from a basic defect in the innermost portion of the cytoplasm of Müller cells, while Manschot also questioned

TABLE 98–1.
ERG and Dark Adaptation Values From Four Patients With X-Linked Juvenile Retinoschisis

	Photopic†				Rod-isolated‡		Bright Flash Dark-Adapted§				DA
Case/age/VA*	Aamp	AIT	Bamp	BIT	Bamp	BIT	Aamp	AIT	Bamp	BIT	FRT
1/7/0.1	50	16	60	38	120	78	250	18	260	54	1.1
2/7/0.4	50	16	60	36	110	80	200	18	210	52	0.5
3/15/0.4	70	15	97	34	74	85	269	18	257	63	1.3
4/56/0.33	33	17	59	35	62	88	223	20	167	57	1.2
Normal‖/54/1.0	39	12	117	32	269	78	156	18	360	54	0.4

*Age = years of age, VA = Snellen best visual acuity converted to the decimal system.
†Aamp = a-wave amplitude in microvolts; AIT = a-wave implicit time in milliseconds.
‡Bamp = b-wave amplitude in microvolts; BIT = b-wave amplitude in milliseconds.
§DA = final rod threshold (FRT) after 40 minutes of dark-adaptation with a 2-degree target at 30 degrees from fixation.
‖Normal = mean age – matched values.

whether the defect could extend to the nerve fiber layer since the degeneration occurs in that layer.[7, 12]

Currently there is no known treatment for X-linked retinoschisis, and the etiology of the disease is unknown. The gene site has been located at Xp22.[4]

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