ANTERIOR ISCHEMIC OPTIC NEUROPATHY: DIAGNOSIS AND MANAGEMENT*

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SWELLING of the optic nerve occurs from a variety of causes such as increased intracranial pressure (papilledema), inflammation (optic neuritis), and drug toxicity (toxic optic neuropathy), but the commonest cause of optic disc swelling in patients over age 55 is interruption of the blood supply to the optic nerve head. This condition has been called by a variety of terms, including "ischemic optic neuritis", "ischemic papillopathy", and "vascular pseudopapillitis"; however, I prefer the term anterior ischemic optic neuropathy. Although Uhthoff[1] first described this entity in 1924, its importance was first emphasized in the American literature by Miller and Smith in 1966.[2] Since this time, numerous authors have presented individual case reports as well as extensive reviews of patients with the condition.[3-6]

ASSOCIATIONS WITH SYSTEMIC DISEASES

Although the best known systemic disease associated with anterior ischemic optic neuropathy is giant cell (temporal) arteritis, a number of other systemic conditions have been associated with its development (Table I), and many cases occur as isolated events in relatively healthy patients and are thus classified as idiopathic.

CLINICAL CHARACTERISTICS

Typically, a patient with anterior ischemic optic neuropathy presents with a sudden, painless loss of visual acuity and visual field associated with optic disc swelling. The age range of patients with this condition is extensive, and depends in part on the etiology of the ischemia. Patients

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CAUSES OF ANTERIOR ISCHEMIC OPTIC NEUROPATHY

Vasculitides	*Systemic vasculopathies*	*Hematologic*	*Ocular*
Giant cell arteritis	Hypertension	Polycythemia vera	? Postcataract
Polyarteritis nodosum	Atherosclerosis	Pernicious anemia	? Low-tension glaucoma
Systemic lupus erythematosus	Diabetes mellitus	Sickle cell disease (trait)	
Buerger's disease	Migraine	Acute hypotension (shock)	
Allergic vasculitis	Takayashu's disease	G-6-P-D deficiency	
Postviral vasculitis	Carotid occlusive disease		
Postimmunization			
Syphilis			
Radiation necrosis			

with diabetes mellitus[7] or migraine,[8] for example, may develop anterior ischemic optic neuropathy as early as the second or third decade of life, while patients with giant cell arteritis are invariably over age 65. The vast majority of patients, however, are between 55 and 75 years of age. Men and women appear equally affected regardless of the cause of the ischemia.

In most patients there are no premonitory symptoms. It is distinctly unusual to have episodes of amaurosis fugax (fleeting blindness) prior to the onset of abrupt visual loss. Although patients with giant cell arteritis may have had pain in the scalp, temple, or jaw, the eye is rarely painful at the time of an attack. On the other hand, patients with migraine may develop a headache simultaneous with the onset of the visual loss or following it. Most patients, however, simply experience sudden visual loss. The degree of visual loss may be severe or the patient may notice only a vague sensation of blurred vision, often described as a shade or veil over a portion of the visual field.

Patients with anterior ischemic optic neuropathy may have only a mild reduction in visual acuity or loss severe enough that light cannot be perceived. Approximately 50% of patients have visual acuity better than 20/100, with the remainder fairly equally divided among those with moderate visual loss (20/100 to 20/400) and very severe visual loss (hand motions, counting fingers, light perception, no light perception). In general, patients with giant cell arteritis have more severe visual loss than do patients with either the idiopathic variety of anterior ischemic optic neuropathy or with other systemic diseases.

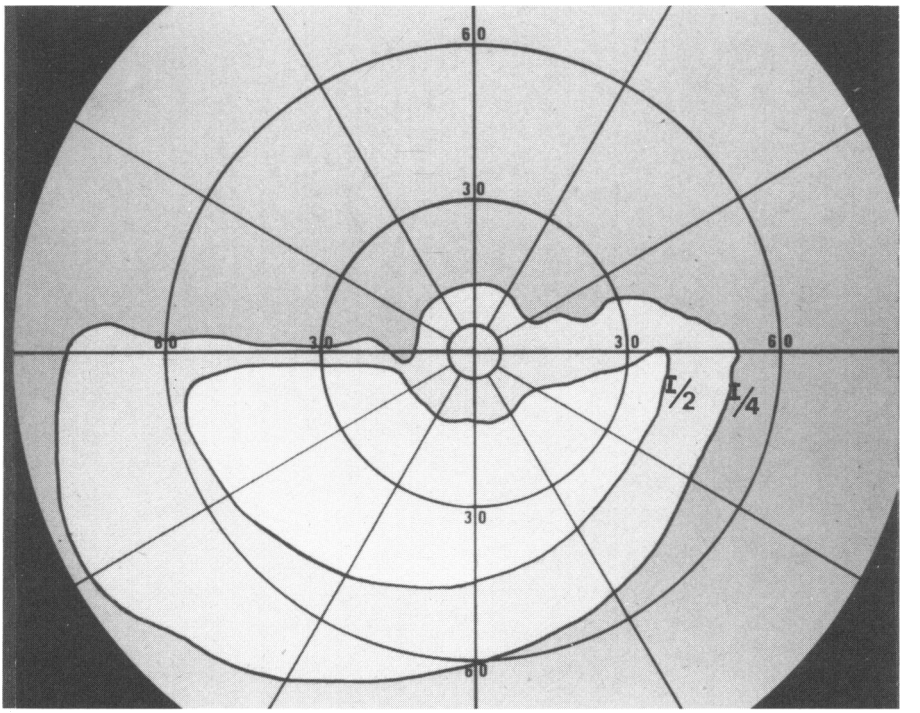

Fig. 1. Visual field as performed on a Goldmann perimeter of the left eye in a patient with AION. There is a complete superior altitudinal defect except for relative sparing of fixation. Visual acuity is 20/200. Reproduced by permission from N. R. Miller and S. L. Fine: *Neuro-Ophthalmologic Diagnosis*. St. Louis, Mosby, 1978.

The visual field defects in patients with anterior ischemic optic neuropathy are virtually pathognomonic of the disease. The most common pattern is an altitudinal defect, usually inferior (Figure 1). Other common defects in the visual field include broad as well as narrow arcuate scotomata (Figures 2 and 3). In rare patients, central or cecocentral scotomas or peripheral constriction may occur. In my experience, 90% of patients with anterior ischemic optic neuropathy have either altitudinal or arcuate visual field defects. Ophthalmoscopically, patients have a swollen optic disc, either diffuse or sectoral. The swollen disc may be pale (Figure 4) or hyperemic (Figure 5), although pale swelling is far more common than hyperemia. Invariably, flame-shaped hemorrhages are present at or near the optic disc margin. In many patients, cotton-wool spots (soft exudates) are also apparent. Hard exudates are almost never seen. It

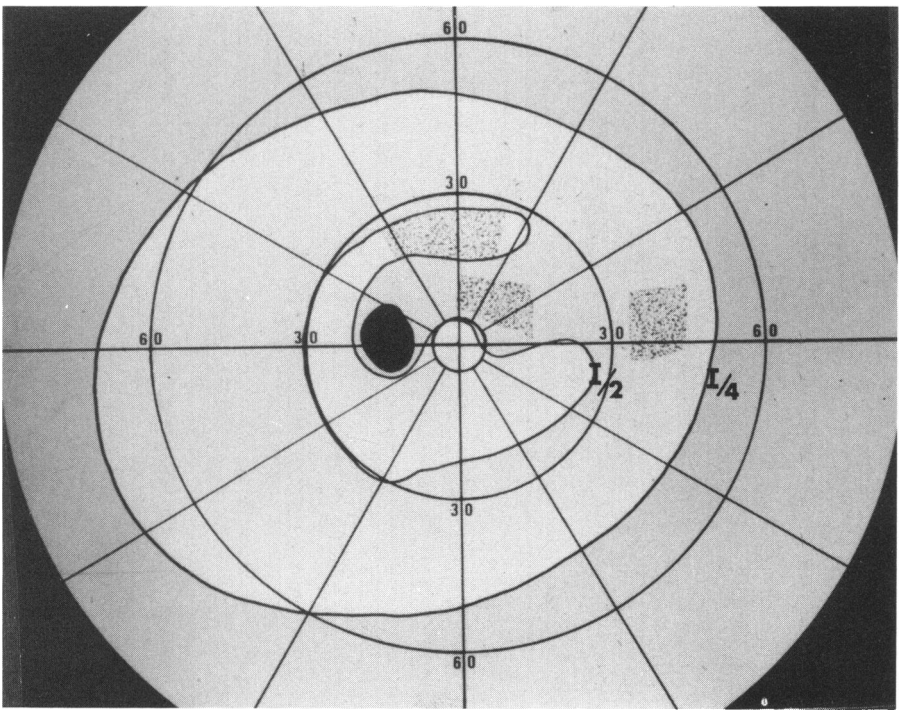

Fig. 2. Visual field as performed on a Goldmann perimeter in the left eye of a patient with AION. There is a narrow, superior arcuate defect to small isopters. Within this region, there are zones in which the larger isopters flicker in and out (shaded areas). Visual acuity is 20/20. Reproduced by permission from N. R. Miller and S. L. Fine: *Neuro-Ophthalmologic Diagnosis*. St. Louis, Mosby, 1978.

should be noted that the disc swelling may resolve rapidly into optic atrophy. For this reason, patients who are seen one to two weeks following an episode of visual loss may present not with optic disc swelling but with optic atrophy.

HISTOPATHOLOGY

Histopathologically, patients with anterior ischemic optic neuropathy show areas of optic nerve infarction within and behind the lamina cribrosa (Figure 6). In patients with giant cell arteritis or other inflammatory vasculitides, periarteriolar aggregates of lymphocytes and focal disruption of the internal elastic lamina in posterior ciliary and orbital arteries are often present and represent a remnant of the original inflammatory process

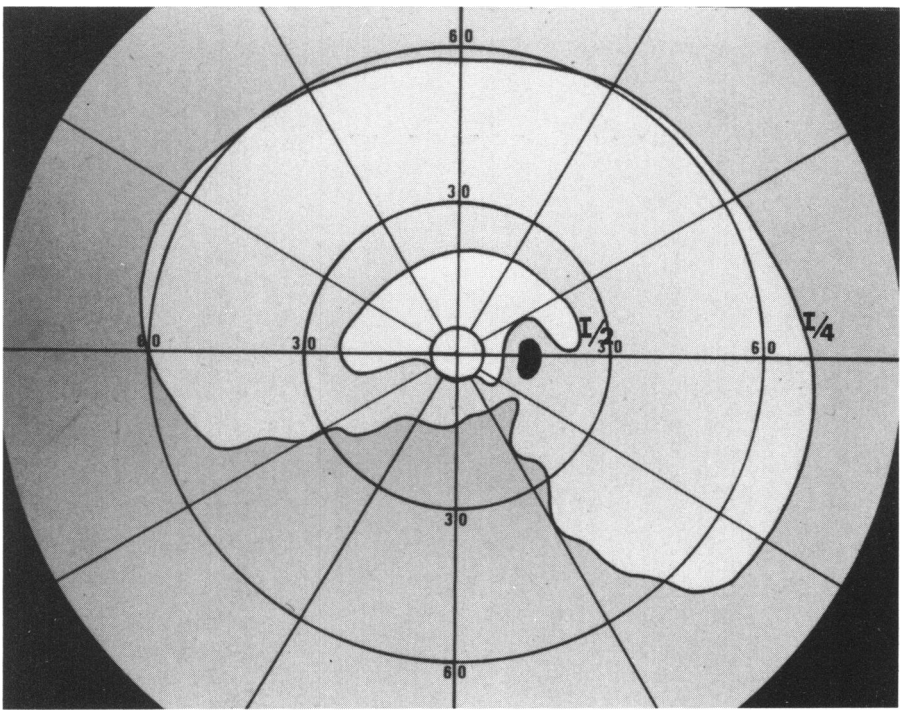

Fig. 3. Visual field as performed on the Goldmann perimeter in the right eye of a patient with AION. There is a broad, inferior arcuate defect to small isopters that becomes an inferior altitudinal defect to smaller isopters. Visual acuity is 20/40. Reproduced by permission from N. R. Miller and S. L. Fine: *Neuro-Ophthalmologic Diagnosis*. St. Louis, Mosby, 1978.

(Figure 7).[9] In addition, Lieberman et al.[10] have described the histophathologic changes in a patient with anterior ischemic optic neuropathy due to a focal infarction 3 mm. behind the lamina cribrosa caused by thromboembolic compromise of three discrete pial and pial-derived arterioles. This is the first report apparently caused by emboli, and it is unlikely that this represents a common etiology of this condition.

MANAGEMENT

Although most often idiopathic, the association of anterior ischemic optic neuropathy with a variety of systemic conditions, particularly giant cell arteritis, necessitates a careful history at the time of initial examination. In patients over age 65, particular attention should be paid to a

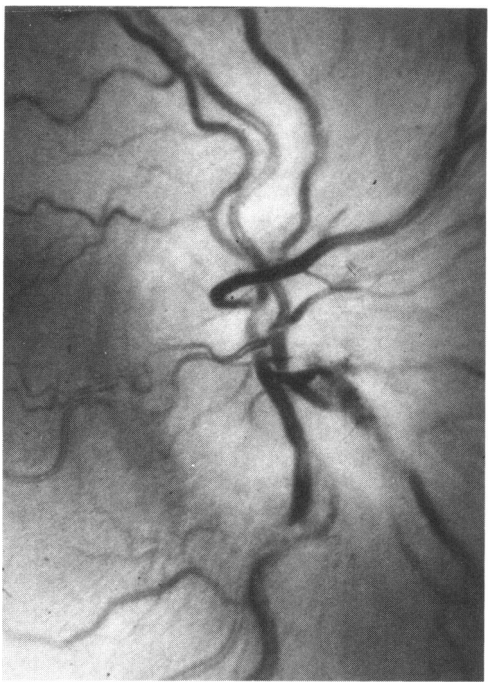

Fig. 4. The right optic disc in a patient with AION shows pale swelling and elevation. A few small nerve fiber layer hemorrhages are seen overlying the disc and at the disc margin.

history of malaise, fatigue, intermittent scalp, temple, or ear pain, jaw claudication, or migratory arthralgias—symptoms that strongly suggest giant cell arteritis and require an immediate erythrocyte sedimentation rate and treatment (see below). Even in the absence of systemic complaints, patients with anterior ischemic optic neuropathy should be evaluated by an internist. In addition, in patients with a history suggestive of the condition but who have optic atrophy when first examined, lateral and antero posterior skull roentgenograms, and possibly computerized tomographic scans, should be obtained to rule out the unlikely possibility of an intracranial mass lesion.

The treatment of anterior ischemic optic neuropathy to a large degree depends on its etiology in the individual patient. Certainly, there is no question that patients with giant cell arteritis should immediately be hospitalized and begun on systemic steroids in a range of 80-120 mg. of

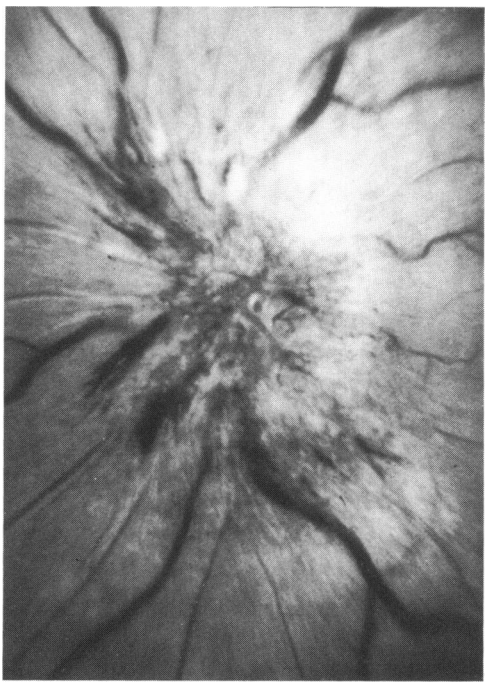

Fig. 5. The left optic disc in a patient with AION shows marked dilation of surface vessels with overall hyperemia. Several small and large nerve fiber layer hemorrhages are present at the disc margin, predominantly inferiorly, and a few cotton-wool spots (cytoid bodies) are present superiorly.

prednisone daily. I advocate immediate institution of both intravenous and oral steroids in an attempt to develop adequate systemic drug levels as soon as possible. Although very few patients whose disease is due to giant cell arteritis obtain improved vision with therapy, this treatment may prevent subsequent ocular or systemic ischemic events, and there are anecdotal reports of significant visual improvement after immediate institution of steroid therapy. Temporal artery biopsy can confirm the clinical diagnosis of giant cell arteritis; however, institution of steroid therapy should never be delayed waiting for the results of a temporal artery biopsy. I would emphasize that giant cell arteritis is a *clinical* diagnosis. The temporal artery biopsy is merely confirmatory, and may be performed several days and perhaps weeks after steroids have been instituted without fear of masking histologic evidence of an active arteritic process. At the

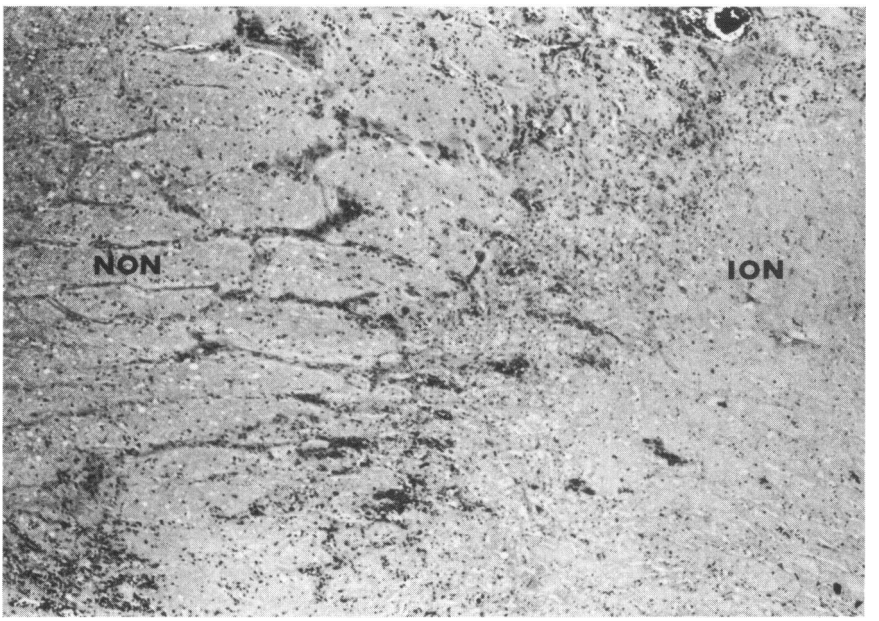

Fig. 6. Longitudinal section of a portion of the optic nerve just posterior to the lamina cribrosa showing the demarcation zone between ischemic optic nerve (ION) and normal optic nerve (NON). Hematoxylin and Eosin X-20.

time of surgery, an adequate specimen of the superficial temporal artery, at least 2 cm. long, should be obtained. The section should be divided into several segments, and all segments should be serially sectioned to look for the classical histologic findings of temporal arteritis: fragmentation of the elastic lamina of the artery and a chronic inflammatory reaction with giant cells (Figures 8 and 9). Patients with clinical evidence of giant cell arteritis and a negative biopsy should continue steroid therapy until a biopsy is performed on the opposite side. Only if both biopsies are negative should the clinical diagnosis of giant cell arteritis be questioned.

In patients with other systemic diseases, the nature of the systemic disease will guide medical therapy; however, the treatment of patients with idiopathic anterior ischemic optic neuropathy is controversial. Although such drugs as heparin, coumadin, and dilantin have clearly been proved ineffective in this condition, the use of steroids has been advocated.[11] At this time no evidence from controlled studies indicates that steroids have a beneficial role in the idiopathic disease. Because steroid

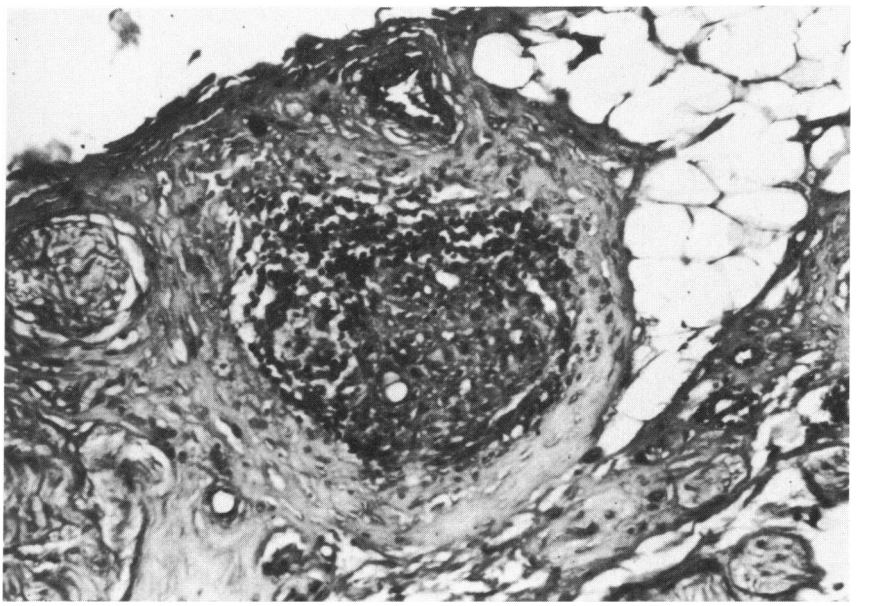

Fig. 7. Cross-section through a posterior ciliary artery in a patient with AION from giant cell arteritis showing chronic inflammation in the wall of the vessel with secondary, inflammatory thrombosis of the lumen. Hematoxylin and Eosin X-50.

therapy may result in various systemic complications, particularly in older patients, I do not advocate the use of steroids in idiopathic anterior ischemic optic neuropathy. Since the underlying abnormality in the idiopathic form appears to be occlusion of small vessels at the optic nerve head, the potential merit of an antiplatelet drug such as aspirin should be considered, though as yet there have been no clinical trials using aspirin in such patients.

Special Considerations

Although in most patients anterior idiopathic optic neuropathy is initially a unilateral disorder, according to Boghen and Glaser[4] as well as in my experience, patients who develop it in one eye have a 40-50% chance of developing it in the other eye months to years after the initial eye is involved. Since the disease may thus be bilateral but nonsimultaneous, patients may present with optic atrophy in one eye and a swollen disc in the other eye. Although Foster Kennedy described a syndrome of unilater-

Fig. 8. Cross-section through a superficial temporal artery in a patient with AION and giant cell arteritis. There is extensive inflammation in all layers of the wall of the vessel and almost complete occlusion of the lumen except for a few areas of recanalization. Hematoxylin and Eosin X-15. Reproduced by permission from N. R. Miller and S. L. Fine: *Neuro-Ophthalmologic Diagnosis*. St. Louis, Mosby, 1978.

al optic atrophy with contralateral papilledema in patients with anterior fossa tumors,[12] it should be emphasized that patients with the Foster Kennedy syndrome have had slowly progressive visual loss in the eye with optic atrophy and have no visual complaints in the eye with papilledema. Patients with bilateral, nonsimultaneous anterior ischemic optic neuropathy have had the sudden loss of visual acuity or visual field or both in both eyes. Accordingly, confusion between the Foster Kennedy syndrome and bilateral, nonsimultaneous anterior ischemic optic neuropathy should never occur.[13]

It has been suggested by Smith[14] that in patients with the idiopathic disease, once an attack has occurred and resolved, the same eye is never attacked again. Although this is true in the vast majority of cases, I have seen several patients with idiopathic anterior ischemic optic neuropathy who have had repeated attacks with sectoral disc swelling despite apparent resolution of the previous attack.

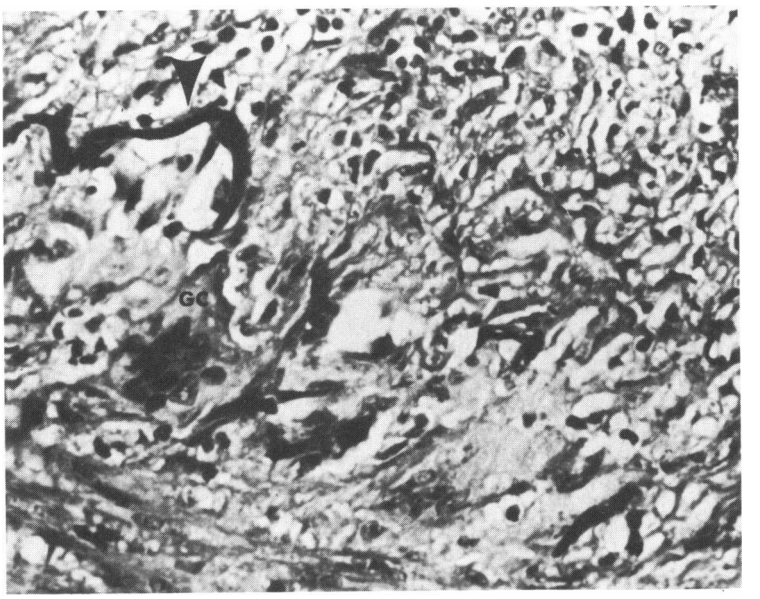

Fig. 9. Magnified view of a section of the wall of the superficial temporal artery seen in Figure 8. Fragmentation of the elastic lamina (arrow) and giant cells (GC) are present. These findings are pathognomonic for giant cell arteritis. Hematoxylin and Eosin X-35. Reproduced by permission from N. R. Miller and S. L. Fine: *Neuro-Ophthalmologic Diagnosis*. St. Louis, Mosby, 1978.

Finally, although anterior ischemic optic neuropathy is almost always heralded by sudden visual loss, Knox and Duke[15] reported a patient with slowly progressive anterior ischemic optic neuropathy due to occlusion of the common and external carotid arteries. In my experience, this is a distinctly unusual occurrence. Patients with severe carotid artery disease may develop a slowly progressive, retrobulbar, ischemic optic neuropathy, but anterior ischemic optic neuropathy in this setting is exceedingly rare.

The finding of a swollen optic disc in an elderly patient with a history of sudden visual loss and an altitudinal or arcuate field defect suggests the diagnosis of anterior ischemic optic neuropathy with its systemic implications for diagnosis and management.

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