CHAPTER 7

Scleritis

Highlights

- Scleritis is a primary inflammation of the sclera, typically manifesting with marked ocular pain and congestion of the deep episcleral plexus.
- Systemic inflammatory conditions are frequently associated with scleritis. It is important to properly investigate and treat these conditions.
- Treatment of scleritis requires systemic anti-inflammatory and/or immunomodulatory drugs.
- Patients with infectious, posterior, or necrotizing scleral inflammation have a high risk of permanent vision loss.

Introduction

Scleritis, inflammation of the sclera, is typically a painful, destructive condition that carries a potential risk of permanent ocular structural damage and visual compromise. Scleritis often manifests with an acute episode of marked ocular pain, swelling, and redness. It can progress to decreased vision when there is necrotizing disease or inflammation of the posterior sclera that affects the choroid and retina. Scleritis can be immune mediated, or it can be associated with infection, trauma, surgery, or medications. Approximately 40% of scleritis cases are associated with a systemic disease (eg, rheumatoid arthritis). Necrotizing scleritis is associated with a systemic process even more frequently, in 50%–60% of cases. Early and accurate diagnosis is critical, as scleral inflammation may be the first sign of a treatable sight-threatening or life-threatening disease.

Classification of Scleritis

Scleritis is classified based on the site (anterior vs posterior), severity (necrotizing vs nonnecrotizing), and pattern of scleral inflammation (diffuse vs nodular). This classification system can help the clinician predict the clinical course, uncover associated systemic disease, plan treatment, and make a prognosis (Table 7-1).

Similar to uveitis, scleritis can also be classified as *noninfectious* or *infectious.* The latter is frequently associated with surgery or trauma. Distinguishing between noninfectious and infectious scleritis is critical because aggressive use of systemic corticosteroids or immunomodulatory therapy in cases with an unidentified underlying infectious etiology can lead to devastating visual consequences.

Table 7-1 Classification of Scleritis

Type	Subtype
Anterior scleritis	Diffuse scleritis
	Nodular scleritis
	Necrotizing scleritis
	With inflammation (granulomatous, vaso-occlusive, postsurgical [surgically induced necrotizing scleritis])
	Scleromalacia perforans (without overt inflammation)
Posterior scleritis	

Pathophysiology

Noninfectious scleritis is an immune-mediated condition that frequently involves the small blood vessels of the sclera. Pathophysiologic mechanisms vary according to the type of scleritis and the associated systemic disease, if any.

The onset is usually characterized by inflammatory cell infiltration of the sclera and episclera that is mediated by proinflammatory cytokines and intercellular adhesion molecules. The diffuse anterior subtype of scleritis is associated with a nongranulomatous response involving macrophages, lymphocytes, and plasma cells that often assumes a perivascular distribution.

In nodular scleritis and particularly in necrotizing scleritis, the inflammatory response is more substantial and specific, involving direct antibody-mediated damage, deposition of immune complexes, or a delayed hypersensitivity response mainly characterized by granulomatous inflammation of the sclera. Inflammation may progress to an essentially vasculitic response, culminating in fibrinoid necrosis of the vessel walls and, eventually, necrosis of the sclera, episclera, conjunctiva, and cornea. Proinflammatory cytokines and activated metalloproteinases may play a role in local scleral and corneal damage.

Fong LP, Sainz de la Maza M, Rice BA, Kupferman AE, Foster CS. Immunopathology of scleritis. *Ophthalmology.* 1991;98(4):472–479.

Usui Y, Parikh J, Goto H, Rao NA. Immunopathology of necrotising scleritis. *Br J Ophthalmol.* 2008;92(3):417–419.

Epidemiology

Scleritis is a relatively uncommon ocular disease. In the United States, the incidence of scleritis is estimated at 3.4–4.1 per 100,000 persons; the prevalence, at 5.2 per 100,000 persons. There are no geographic or racial differences in scleritis incidence and prevalence, but most epidemiologic studies show that the disease is more common in females. In tertiary centers, scleritis makes up 0.1%–2.6% of newly referred cases. Diffuse anterior scleritis is the most common form of the disease. Although noninfectious scleritis is more common in the United States, it is important to consider infectious causes of scleritis

(ie, herpetic, nocardial, mycobacterial, and fungal) in patients who have risk factors related to their medical or surgical history or geographic origin.

Homayounfar G, Nardone N, Borkar DS, et al. Incidence of scleritis and episcleritis: results from the Pacific Ocular Inflammation Study. *Am J Ophthalmol*. 2013;156(4):752–758.

Honik G, Wong IG, Gritz DC. Incidence and prevalence of episcleritis and scleritis in Northern California. *Cornea*. 2013;32(12):1562–1566.

Williamson J. Incidence of eye disease in cases of connective tissue disease. *Trans Ophthalmol Soc UK*. 1974;94(3):742–752.

Clinical Presentation

Anterior scleritis is defined as scleral inflammation anterior to the recti muscles. Individuals with anterior scleritis usually present with tenderness and severe pain in the affected eye and periocular area. The pain may worsen with eye movement and radiate to the face and jaw. When cornea or posterior sclera is involved, vision may be affected. Anterior chamber reaction may occasionally be seen.

Sometimes the clinician will find it easier to appreciate the severity of scleritis activity by looking at the eye externally, lifting the upper eyelid, and using daylight or full-room lights rather than the slit lamp. The eye with scleritis typically shows scleral edema and intense hyperemia (Fig 7-1), leading to a characteristic violaceous hue on external examination. Slit-lamp examination characteristically discloses marked dilatation of the deep episcleral plexus, which is displaced outward because of scleral edema/inflammatory cell infiltration. This is an important distinction from episcleritis, in which no scleral edema is found and only the superficial episcleral plexus is affected. Careful utilization of a topical vasoconstrictor (eg, phenylephrine drops) can also help distinguish episcleritis, in which the vessels blanch, from scleritis, in which there is partial or no blanching. However, nonblanching conjunctival injection can occur in other forms of ocular inflammation, such as acute anterior uveitis and endophthalmitis, so the phenylephrine test does not solely indicate the presence of scleritis. (The presence of high-grade intraocular inflammation distinguishes these forms of ocular inflammation from scleritis.) Close biomicroscopic inspection is also important to assess for the presence of signs of necrotizing disease (Fig 7-2).

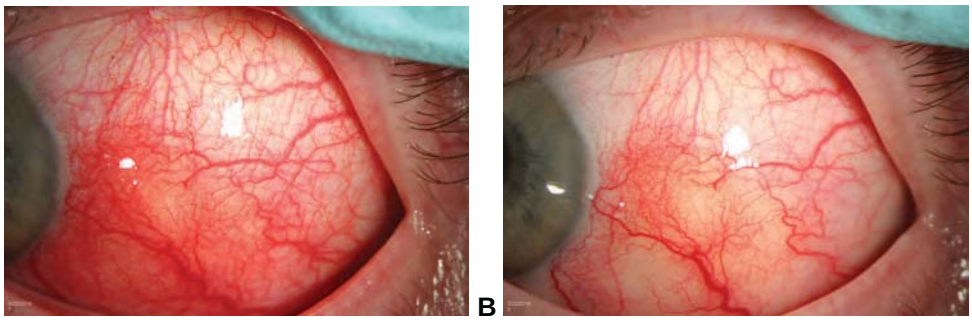

Figure 7-1 Diffuse anterior scleritis. Dilation of deep episcleral vessels before **(A)** and after **(B)** instillation of phenylephrine is demonstrated. *(Courtesy of H. Nida Sen, MD/National Eye Institute.)*

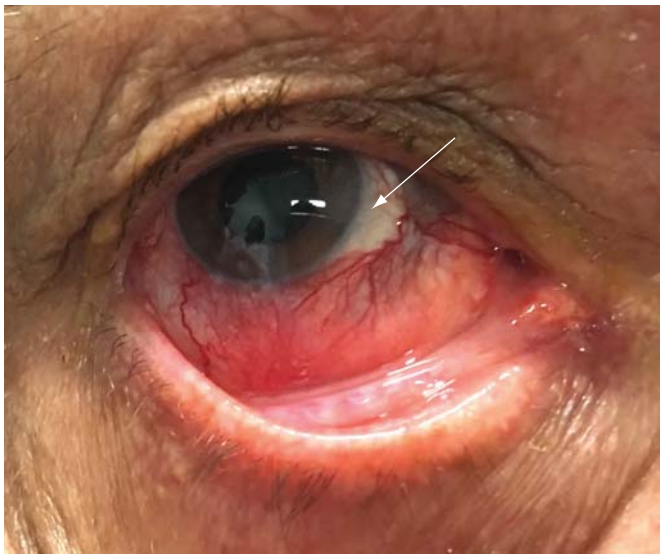

Figure 7-2 Anterior necrotizing scleritis. The eye shows active scleral inflammation associated with an avascular area *(arrow)* close to the limbus, adjacent to an area of scleral thinning. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

Sainz de la Maza M, Molina N, Gonzalez-Gonzalez LA, Doctor PP, Tauber J, Foster CS. Clinical characteristics of a large cohort of patients with scleritis and episcleritis. *Ophthalmology*. 2012;119(1):43–50.

Sainz de la Maza M, Vitale AT. Scleritis and episcleritis. *Focal Points: Clinical Modules for Ophthalmologists*. American Academy of Ophthalmology; 2009, module 4.

Diffuse Anterior Scleritis

The diffuse form of anterior scleritis is the most common and least severe type of scleritis; in most affected individuals, the risk of complications is less than 10%. Onset is frequently insidious, beginning slowly and building up to severe pain with deep episcleral vascular congestion. Scleral swelling/infiltration is more diffuse (see Fig 7-1), so no nodule is formed. Recurrences are very common. The main systemic associations include rheumatoid arthritis, systemic lupus erythematosus, and relapsing polychondritis. Inflammatory bowel disease, reactive arthritis, and less frequently, ankylosing spondylitis can also be implicated.

Nodular Anterior Scleritis

Features of nodular anterior scleritis include a tender and typically immobile scleral nodule, in addition to the local or diffuse violaceous hue associated with markedly engorged deep episcleral vessels. In up to 10% of patients who present with nodular anterior scleritis, the condition progresses to necrotizing disease, particularly when there is an underlying systemic inflammatory condition. It is important to rule out infectious etiologies of

nodular anterior scleritis, especially in the presence of necrosis (Fig 7-3). Necrotic change often manifests as an avascular area in the center of the nodule (eventually with superficial ulceration) or as a new, discrete lesion that extends circumferentially. After scleral inflammation resolves, increased scleral translucency may be seen, eventually with thinning that reveals the bluish hue of underlying uveal tissue (Fig 7-4).

Necrotizing Scleritis

Necrotizing scleritis is the most severe and destructive type of scleritis, and therefore, it is more likely to lead to vision loss. It is frequently associated with systemic disease (approximately 50%–60% of cases), including life-threatening vasculitic diseases, and more commonly affects older individuals. Mortality rates of patients with necrotizing scleritis associated with systemic inflammatory disease had been as high as 30% but improved significantly with the development of biologic therapies.

Necrotizing scleritis can be divided into 2 groups: necrotizing scleritis with inflammation and scleromalacia perforans (necrotizing scleritis without overt inflammation). These are discussed in the following subsections.

Doshi RR, Harocopos GJ, Schwab IR, Cunningham ET Jr. The spectrum of postoperative scleral necrosis. *Surv Ophthalmol*. 2013;58(6):620–633.

Lin CP, Su CY. Infectious scleritis and surgical induced necrotizing scleritis. *Eye (Lond)*. 2010;24(4):740.

Figure 7-3 Infectious scleritis due to actinomycetes. A nodule is visible superotemporally, and a large area of scleral thinning can be seen inferiorly. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

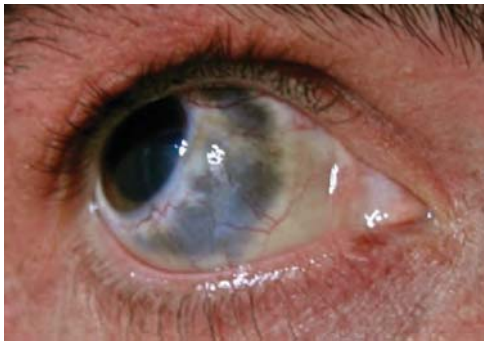

Figure 7-4 Infectious scleritis due to actinomycetes (same patient as in Fig 7-3). The inflammation resolved after antibiotic treatment, but an arch of scleral thinning remained. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

Necrotizing scleritis with inflammation

Necrotizing scleritis with inflammation is characterized by overt signs and symptoms of scleral inflammation. It can be subdivided into 3 forms: vaso-occlusive, granulomatous, and postsurgical (surgically induced necrotizing scleritis).

In the *vaso-occlusive form,* inflammation causes destruction of the vessel walls, leading to ischemia and nonperfusion, associated with scleral edema/infiltration (Fig 7-5). The limbal area and peripheral cornea are often spared. The vaso-occlusive form is usually associated with infection or an underlying systemic inflammatory disease.

The *granulomatous* form typically starts with necrotizing inflammation of the limbal area, subsequently extending anteriorly to the cornea and posteriorly to the sclera. The inflamed area assumes a "lumpy" aspect, associated with inflammatory cell infiltration and edema. Eventually, necrosis and ulceration of the affected tissues (cornea, conjunctiva, episclera, and sclera) develop. The granulomatous form is frequently associated with systemic vasculitides, particularly granulomatosis with polyangiitis (formerly, Wegener granulomatosis) (Fig 7-6) and polyarteritis nodosa. It is important to note that other forms of necrotizing scleritis may also display granulomatous inflammation on histologic examination.

When necrotizing scleritis arises after surgical trauma to the sclera, it is termed *surgically induced necrotizing scleritis (SINS).* This rare condition may arise a few months to several years after the surgery. It is important to exclude infection in these cases to distinguish SINS from postoperative infectious scleritis. Procedures associated with postsurgical scleritis include cataract, strabismus, or retinal surgery; trabeculectomy; cryotherapy; and pterygium excision with use of mitomycin C or beta radiation. Recalcitrant inflammation, with progressive necrosis of the sclera, develops commonly at the site of the surgical insult (Fig 7-7), or sometimes more distant from the surgical incision. Many patients with SINS have an underlying autoimmune disease; surgical injury of the sclera is the possible trigger for the local inflammatory process.

Watson PG, Hazleman BL, McCluskey P, Pavésio CE. *The Sclera and Systemic Disorders*. 3rd ed. JP Medical; 2012.

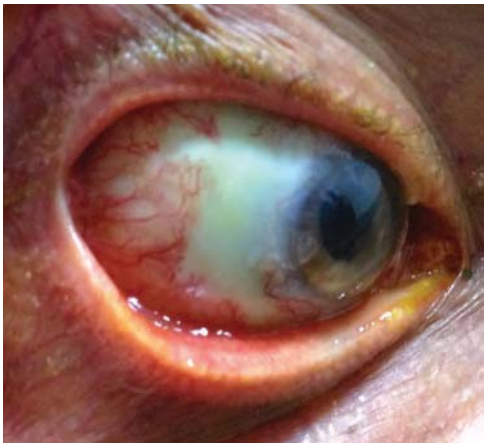

Figure 7-5 Vaso-occlusive form of necrotizing scleritis. A large avascular area adjacent to the limbus is evident. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

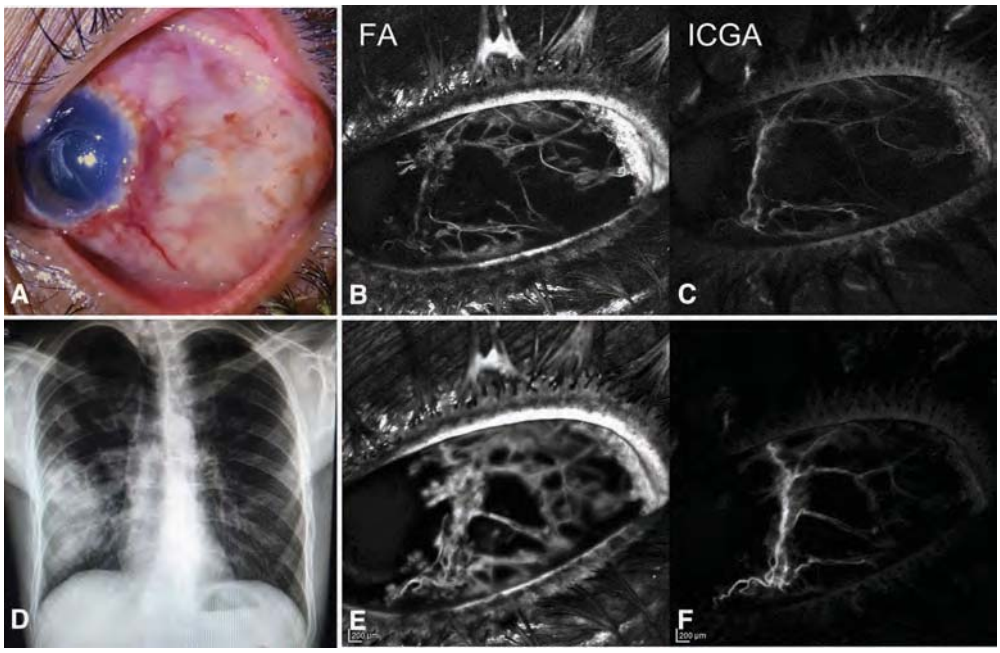

Figure 7-6 Granulomatous form of necrotizing scleritis in a patient who had granulomatosis with polyangiitis with concomitant lung and kidney disease. Infiltration of the sclera and peripheral cornea is seen, with formation of multiple necrotic and avascular areas **(A).** Simultaneous fluorescein angiography **(B, E)** and indocyanine green angiography **(C, F)** delineate areas of necrosis (with absence of episcleral and conjunctival vessels) and peripheral corneal neovascularization. Chest radiograph **(D)** shows infiltrates in the right lung *(bottom left).* *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

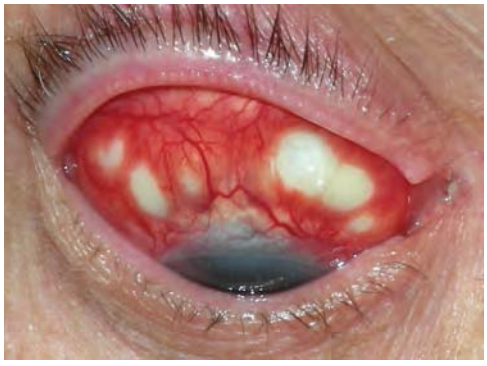

Figure 7-7 Surgically induced necrotizing scleritis. Multiple foci of scleral necrosis are present after extracapsular cataract surgery. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

Scleromalacia perforans (necrotizing scleritis without overt inflammation)

Scleromalacia perforans is characterized by a lack of significant symptoms and signs of clinical scleral inflammation. On histologic examination, there is inflammatory cell infiltration in the sclera. (Historically, this entity has been called *scleritis without inflammation,* which is a misnomer.) The necrotizing granulomatous response leads to progressive (and "silent") destruction of the scleral tissue, which may extend circumferentially, eventually

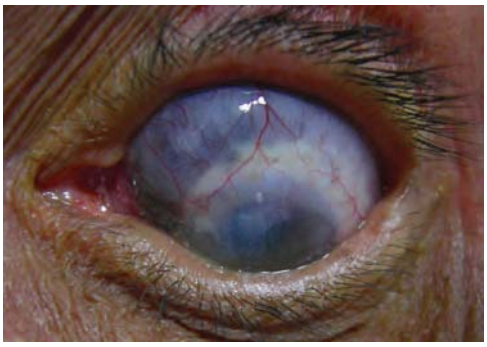

Figure 7-8 Scleromalacia perforans. The eye has profuse loss of scleral tissue with protrusion of underlying uveal tissue, which is covered by conjunctiva. There are no overt inflammatory signs. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

leaving a staphyloma. Patients with scleromalacia perforans are often older adult women with long-standing rheumatoid arthritis. They typically present with yellowish or white necrotic plaques involving the sclera and episclera (sequestrum) of both eyes. These plaques are surrounded by mildly dilated episcleral vessels. Associated staphylomata are covered by conjunctiva and a thin, translucent layer of fibrous tissue (Fig 7-8). Despite the term *perforans,* these lesions do not usually perforate spontaneously.

Posterior Scleritis

Posterior scleritis is a sight-threatening entity that is defined as scleral inflammation posterior to the ora serrata. Unless it is concomitant with anterior scleritis, posterior scleritis may be difficult to recognize because of the lack of inflammatory signs in the anterior part of the sclera. The rate of association with systemic inflammatory conditions is comparable to that of anterior scleritis. Patients often report severe deep, boring eye pain and tenderness on palpation, but in 30%–40% of patients, these symptoms are mild or absent. Decreased vision is often reported; the location of the inflammation and the involvement of underlying structures determine whether vision is affected. Possible signs include choroidal detachment and folds, subretinal fluid, and optic disc edema (Fig 7-9). Anterior rotation of the pars plicata (ciliary body) can displace the lens–iris diaphragm anteriorly, leading to angle closure and acute elevation of intraocular pressure. Involvement of extraocular muscles (myositis) occasionally leads to diplopia.

McCluskey PJ, Watson PG, Lightman S, Haybittle J, Restori M, Branley M. Posterior scleritis: clinical features, systemic associations, and outcome in a large series of patients. *Ophthalmology.* 1999;106(12):2380–2386.

Infectious Scleritis

A wide variety of agents can infect the sclera, including *Pseudomonas* organisms (most common after pterygium excision), *Actinomyces* and *Nocardia* species, mycobacteria, fungi such as *Fusarium* and *Aspergillus* species, and gram-positive cocci (*Staphylococcus pneumoniae* and *Streptococcus* species). In addition, infection with herpes simplex virus or varicella-zoster virus can cause chronic scleritis. Infectious scleritis can occur after any ocular surgery, including pterygium surgery (especially when beta radiation or mitomycin C

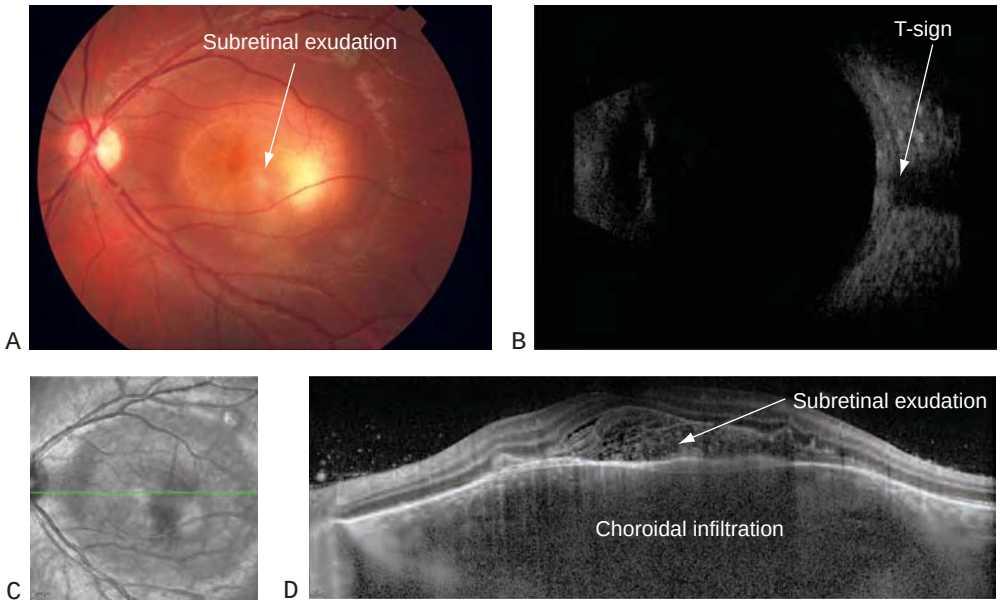

Figure 7-9 Posterior scleritis. **A,** Subretinal exudation is seen on fundus photography. **B,** B-scan reveals accumulation of sub-Tenon fluid contiguous to the optic nerve shadow (T-sign). **C, D,** Spectral-domain optical coherence tomography shows marked choroidal infiltration leading to serous detachment of the neurosensory retina and the underlying retinal pigment epithelium. *(Courtesy of Daniel V. Vasconcelos-Santos, MD, PhD.)*

is used), scleral buckling, cataract surgery, and pars plana vitrectomy. The precipitating surgery may have occurred recently, several months earlier, or in rare cases, many years before. Infectious scleritis can also develop if a penetrating ocular injury site is contaminated by vegetable or organic matter.

Similar to noninfectious scleritis, infectious scleritis can manifest with eye pain, redness, and decreased vision. Nodular and necrotizing scleral disease are more common in infectious versus noninfectious scleritis, and if there is associated intraocular inflammation (sclerouveitis), it can be disproportionately more substantial in infectious scleritis. The sclera appears necrotic, thin, and avascular, with inflammation at the edges (see Fig 7-3), usually at the site of a surgical or traumatic wound. A mucopurulent discharge may be present, depending on the infectious agent.

Raiji VR, Palestine AG, Parver DL. Scleritis and systemic disease association in a community-based referral practice. *Am J Ophthalmol.* 2009;148(6):946–950.

Riono WP, Hidayat AA, Rao NA. Scleritis: a clinicopathologic study of 55 cases. *Ophthalmology.* 1999;106(7):1328–1333.

Diagnosis

Diagnosis of scleritis is based on a detailed clinical history, careful external eye inspection, and findings from slit-lamp and fundus examinations; these findings are discussed in the section Clinical Presentation. Complementary B-scan ultrasonography, fundus

angiography, and optical coherence tomography (OCT) can help better delineate scleral involvement. An appropriate laboratory workup is warranted to rule out underlying systemic inflammatory diseases (Table 7-2), which are often associated with scleritis and may be life-threatening, especially those diseases associated with necrotizing scleritis. Referral to a rheumatologist may be required for confirmatory diagnosis of systemic diseases.

Anterior segment spectral-domain OCT provides noninvasive imaging that may document local changes at the level of the sclera, episclera, Tenon capsule, conjunctiva, cornea, and angle structures; however, its clinical utility is unclear at this time. Ultrasound biomicroscopy may be used to image the anterior segment and ciliary body, but this technique is often technically cumbersome and painful in tender eyes with scleritis. B-scan ultrasonography is useful for confirming suspicion of posterior scleritis

Table 7-2 Investigations for Noninfectious Inflammatory Conditions Associated With Scleritis

Disease	Potentially Useful Investigations
Rheumatoid arthritis	RF, anti-CCP, ESR, CRP, joint radiography, C3, C4
Systemic lupus erythematosus	ANA, CBC, urine sediment, C3, C4
Juvenile idiopathic arthritis	ANA, HLA-B27, RF, anti-CCP, joint radiography
Ankylosing spondylitis	HLA-B27, ESR, CRP, lumbosacral radiography
Reactive arthritis	HLA-B27, ESR, CRP, joint radiography, cultures (urogenital tract, throat, stool, synovial fluid)
Enteropathic arthritis	HLA-B27, lumbosacral radiography
Psoriatic arthritis	HLA-B27, ESR, CRP
Granulomatosis with polyangiitis	c-ANCA-specific antibodies (anti-PR3), tissue biopsy, radiography (chest/sinuses), urine sediment, C3, C4
Polyarteritis nodosa	p-ANCA-specific antibodies (anti-MPO), tissue biopsy, urine sediment
Microscopic polyangiitis	p-ANCA-specific antibodies (anti-MPO)
Relapsing polychondritis	ESR, CRP, cartilage biopsy
Churg-Strauss syndrome (allergic granulomatous angiitis)	CBC (eosinophilia), p-ANCA-specific antibodies (anti-MPO), tissue biopsy, urine sediment, C3, C4
Leukocytoclastic vasculitis	Anti-HCV, RF, ESR, CRP
Cogan syndrome	Hearing test
Giant cell arteritis	ESR, CRP, CBC, temporal artery biopsy
Takayasu arteritis	Cardiac catheterization
Sarcoidosis	ACE (lysozyme for patients using ACE inhibitors), chest x-ray or CT, tuberculin skin test or interferon-gamma release assay, tissue biopsy

ACE = angiotensin-converting enzyme; ANA = antinuclear antibodies; c-ANCA = cytoplasmic pattern of antineutrophil cytoplasmic antibodies; CBC = complete blood count; CCP = cyclic citrullinated peptide; CRP = C-reactive protein; CT = computed tomography; ESR = erythrocyte sedimentation rate; HCV = hepatitis C virus; HLA = human leukocyte antigen; MPO = myeloperoxidase; p-ANCA = perinuclear antineutrophil cytoplasmic antibodies; PR3 = serine proteinase 3; RF = rheumatoid factor.

or assessing concomitant posterior scleral involvement in eyes with anterior scleritis; imaging typically reveals thickening of the sclera, associated with accumulation of fluid in the sub-Tenon space. When adjacent to the optic nerve shadow, this accumulation may lead to the classic "T-sign" (see Fig 7-9). Ultrasonography may also be helpful to assess the involvement of adjacent structures, including the choroid, ciliary body, retina, extraocular muscles, and orbit. Concern about an orbital process requires further workup with computed tomography and magnetic resonance imaging with and without gadolinium.

In cases of posterior scleritis, fundus fluorescein or indocyanine green angiography can delineate the extent of disease and may be helpful in differential diagnosis. Fluorescein can show optic nerve staining, multiple pinpoint leakages, and pooling of dye within subretinal fluid in the late phase of the angiogram.

If there is high clinical suspicion for infectious scleritis, microbiological examination of scleral scrapings and incisional biopsy of the sclera can be very helpful. Biopsy is also valuable when there is a possibility of neoplastic conditions, such as conjunctival carcinomas and lymphomas. These can masquerade as or be associated with a variable degree of scleral inflammation. Intraocular tumors, particularly large uveal melanomas, occasionally lead to engorgement of overlying episcleral *(sentinel)* vessels.

Levison AL, Lowder CY, Baynes KM, Kaiser PK, Srivastava SK. Anterior segment spectral domain optical coherence tomography imaging of patients with anterior scleritis. *Int Ophthalmol.* 2016;36(4):499–508.

Liu Z, Zhao W, Tao Q, Lin S, Li X, Zhang X. Comparison of the clinical features between posterior scleritis with exudative retinal detachment and Vogt-Koyanagi-Harada disease. *Int Ophthalmol.* 2021;42(2):479–488.

Nieuwenhuizen J, Watson PG, Emmanouilidis-van der Spek K, Keunen JE, Jager MJ. The value of combining anterior segment fluorescein angiography with indocyanine green angiography in scleral inflammation. *Ophthalmology*. 2003;110(8):1653–1666.

Okhravi N, Odufuwa B, McCluskey P, Lightman S. Scleritis. *Surv Ophthalmol.* 2005;50(4): 351–363.

Treatment

Treatment of scleritis depends on the type and extent of scleral inflammation and the results of diagnostic investigations (see Table 7-2). When an underlying systemic disease is present, particularly when it is associated with necrotizing scleritis, aggressive control of the disease is essential, as it may be a major determinant of mortality. It is also important to manage infectious and neoplastic etiologies accordingly. Although it is an infrequent occurrence (up to 15% of cases), if necrotizing scleritis develops in a patient who initially had nonnecrotizing disease, further investigation for associated causes and escalation of therapy are warranted.

Topical corticosteroids may be used to control associated iridocyclitis, present in nearly one-third of individuals with severe scleritis. This measure may prevent complications such as anterior/posterior synechiae, uveitic glaucoma, and cataract.

Systemic Treatment

Topical therapy is usually ineffective to treat scleritis; therefore, treatment is systemic, ranging from oral nonsteroidal anti-inflammatory drugs (NSAIDs) to immunomodulatory agents.

In individuals with mild to moderate noninfectious anterior scleritis, either diffuse or nodular, primary management consists of oral NSAIDs for no more than 2 weeks, in the absence of specific contraindications (Table 7-3). Caution is advised because of the risk of gastroduodenal ulceration, which may be decreased by concomitant use of histamine H_2 receptor antagonists or proton pump inhibitors. Also, it is important to monitor renal function closely.

Severe noninfectious anterior scleritis, refractory to NSAIDs or with posterior or necrotizing disease, is managed with systemic corticosteroids, typically with an initial dosage of 1 mg/kg/day of prednisone (up to 60–80 mg/day) or equivalent, followed by a slow tapering regimen. Careful monitoring for adverse effects is critical. It is important to distinguish noninfectious scleritis from infectious scleritis because high-dose corticosteroids or immunosuppressive agents can worsen scleritis in the presence of active, untreated infection. Systemic corticosteroids should not be given until infection has been ruled out or treated.

When scleral inflammation recurs or is refractory to systemic corticosteroids, especially in necrotizing scleritis, immunomodulatory drugs (mainly antimetabolites, such as methotrexate, mycophenolate mofetil, or azathioprine) are indicated either as corticosteroid-sparing agents or as adjuvants. Biologic immunomodulatory agents, such as tumor necrosis factor inhibitors (eg, infliximab, adalimumab), and anti-CD20 agents (rituximab), have also been successfully employed for refractory cases.

In the setting of severe necrotizing or nonnecrotizing scleritis, intravenous pulse therapy with methylprednisolone (1 g daily for 3 days) can be used initially, followed by high-dose oral prednisone (up to 60–80 mg per day). Alkylating agents, such as cyclophosphamide, are reserved for severe necrotizing involvement of the sclera and cornea, especially if there is impending risk of perforation. Scleritis associated with granulomatosis with polyangiitis and polyarteritis nodosa typically requires more aggressive therapy with rituximab or cyclophosphamide.

Infectious scleritis can be treated with systemic (and topical) antimicrobials plus surgical debridement as needed. Microorganisms may be difficult to eradicate from the

Table 7-3 NSAID Dosage for Management of Mild to Moderate Noninfectious Anterior Scleritis[a]

Drug	Dosage
Flurbiprofen	50–100 mg 3 times daily
Ibuprofen	600 mg 3–4 times daily
Indomethacin	25–50 mg 3 times daily
Naproxen	500 mg 2 times daily

NSAID = nonsteroidal anti-inflammatory drug.

[a] NSAIDs should not be used for long-term management of scleritis.

sclera, and long-term antimicrobial treatment may be necessary. If there is severe scleral thinning, scleral grafting may be utilized.

Individuals with nonnecrotizing, noninfectious scleritis who cannot tolerate systemic therapy or who have residual scleral inflammation after treatment may be candidates for subconjunctival injection of triamcinolone (40 mg/mL, 0.2 mL in each active quadrant). Before administering a local corticosteroid injection, it is paramount to rule out infectious etiologies. Associated systemic inflammatory diseases should also be under control. In each case, it is important to weigh the risks of the injection—cataract and secondary ocular hypertension/glaucoma and, less likely, of scleral melting and infection—against the possible benefits.

Cao JH, Oray M, Cocho L, Foster CS. Rituximab in the treatment of refractory noninfectious scleritis. *Am J Ophthalmol*. 2016;164:22–28.

Daniel Diaz J, Sobol EK, Gritz DC. Treatment and management of scleral disorders. *Surv Ophthalmol*. 2016;61(6):702–717.

Jabs DA, Mudun A, Dunn JP, Marsh MJ. Episcleritis and scleritis: clinical features and treatment results. *Am J Ophthalmol*. 2000;130(4):469–476.

Sobrin L, Christen W, Foster CS. Mycophenolate mofetil after methotrexate failure or intolerance in treatment of scleritis and uveitis. *Ophthalmology*. 2008;115(8):1416–1421.

Sohn EH, Wang R, Read R, et al. Long-term, multicenter evaluation of subconjunctival injection of triamcinolone for non-necrotizing, noninfectious anterior scleritis. *Ophthalmology*. 2011;118(10):1932–1937.

Surgical Treatment

For eyes with severe refractory necrotizing scleritis, surgical treatment may be considered to reinforce the scleral wall in the setting of an impending perforation or to close a spontaneous or traumatic corneal and/or scleral defect (tectonic grafting). Figure 7-10 shows the postoperative appearance of an eye after scleral grafting. Cadaveric donor sclera may be used for grafting, but it can melt. Consequently, some authors recommend the use of autogenous periosteum or donor cornea. For patients with infectious scleritis, antimicrobial agents are used, sometimes accompanied by debridement of necrotic scleral tissue to reduce the load of microorganisms and improve penetration of the medication.

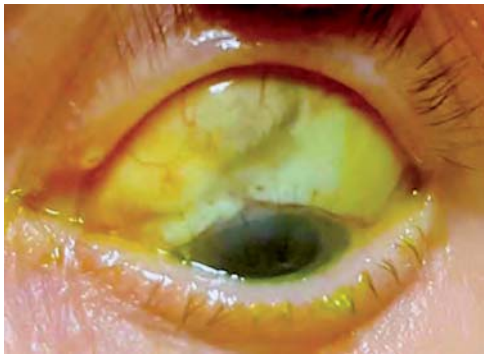

Figure 7-10 Postoperative appearance of a scleral graft. *(Courtesy of Humeyra Karacal, MD.)*

Prognosis

The prognosis of scleritis depends on the severity and extent of ocular structure involvement and the presence of underlying systemic diseases. Nonnecrotizing noninfectious anterior (diffuse or nodular) scleritis has a good prognosis with treatment; most eyes maintain good visual function over time. However, patients with posterior scleritis, necrotizing scleritis, or infectious scleritis have a high risk of permanent vision loss. Individuals with necrotizing scleritis also have higher mortality rates because of the frequent association with life-threatening vasculitic disorders. Proper and timely management of these disorders is thus very important.