The Journal of Emergency Medicine, Vol. 57, No. 5, pp. 705–709, 2019

0736-4679/$ - see front matter

https://doi.org/10.1016/j.jemermed.2019.04.034

Ultrasound in Emergency Medicine

# POINT-OF-CARE ULTRASOUND IN THE EVALUATION OF THE ACUTELY PAINFUL RED EYE

Matthew Tabbut, MD, FACEP,*† Adam Bates, MD,* Geoffrey Marple, MD,* Diane Gramer, RDMS,* and Byron Tabbut, MD‡

*Division of Emergency Ultrasound, Department of Emergency Medicine, MetroHealth Medical Center, Cleveland, Ohio, †Case Western Reserve University School of Medicine, Cleveland, Ohio, and ‡M&M Eye Institute, Prescott, Arizona

*Corresponding Address:* Matthew Tabbut, MD, FACEP, Department of Emergency Medicine, MetroHealth Medical Center, 2500 MetroHealth Dr. BG-3, Cleveland, OH 44109

☐ **Abstract—Background: Visual loss, ocular pain, and red eye are common presentations to front-line physicians in the emergency department, urgent care centers, or the primary care office. In recent decades, point-of-care ultrasound (POCUS) has been used by clinicians at the bedside in the evaluation and management of a vast array of patients, including those with ocular complaints. Case Report: A 33-year-old man presented to the emergency department with left eye pain for 4 weeks' duration. The physical examination revealed visual acuity of 20/400 in the affected eye and diffuse conjunctival injection with perilimbal sparing and scleral edema. Using POCUS, he was noted to have diffuse thickening of the globe wall in the symptomatic eye with a thin layer of fluid posterior to the globe in Tenon's space and mild enlargement of the optic nerve sheath diameter. He was ultimately diagnosed with posterior scleritis. Why Should an Emergency Physician be Aware of This?: Posterior scleritis carries the potential for significant visual impairment when the diagnosis is missed or delayed. POCUS findings can aid the front-line physician in making the diagnosis of posterior scleritis allowing earlier initiation of appropriate therapy and follow-up.** © **2019 Elsevier Inc. All rights reserved.**

☐ **Keywords—emergency department; eye; ophthalmology; POCUS; point-of-care ultrasound; posterior scleritis; T sign; Tenon's space**

Reprints are not available from the authors.

## INTRODUCTION

Visual loss, ocular pain, and red eye are common presentations to front-line physicians in the emergency department, urgent care centers, or the primary care office. While most causes are benign, there are several critical, vision-threatening etiologies of the acutely painful red eye that need to be diagnosed by the nonophthalmologist caring for these patients. The differential diagnosis is vast and categorized by anatomic region of the eye. Differential considerations for atraumatic, monocular eye pain or redness include keratitis, conjunctivitis, anterior scleritis,

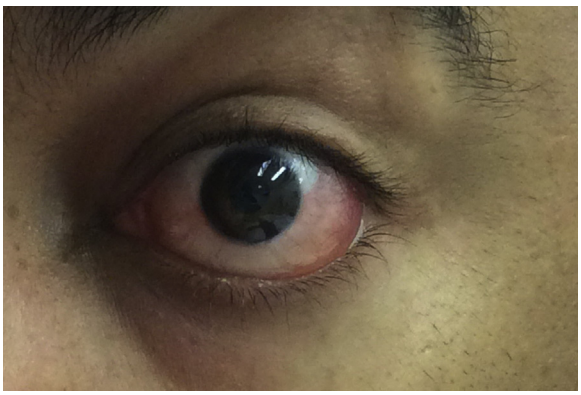

**Figure 1. View of patient's left eye.**

RECEIVED: 22 April 2019;
ACCEPTED: 25 April 2019

uveitis, iritis, acute angle closure glaucoma, endophthalmitis, and posterior scleritis.

Point-of-care ultrasound (POCUS) is used by clinicians at the bedside in the evaluation and management of a vast array of patient complaints. POCUS has been demonstrated to be a useful bedside tool in the evaluation of patients with acute vision loss with findings ranging from retinal or vitreous detachments to the evaluation of optic nerve sheath diameter or papilledema in the evaluation of elevated intracranial pressure (1–3).

We report the use of POCUS in the evaluation of a patient presenting to our ED complaining of a red and painful eye with acute vision loss and suggest an additional ocular finding that can be demonstrated on POCUS.

## CASE REPORT

A 33-year-old man presented to the emergency department (ED) with left eye pain for 4 weeks' duration. He reported a history of previous retinal detachment and unilateral, anterior uveitis for which he had previously been prescribed oral and ophthalmic prednisone. He restarted his prednisone drops several days before his ED visit without relief. In addition to pain, the patient

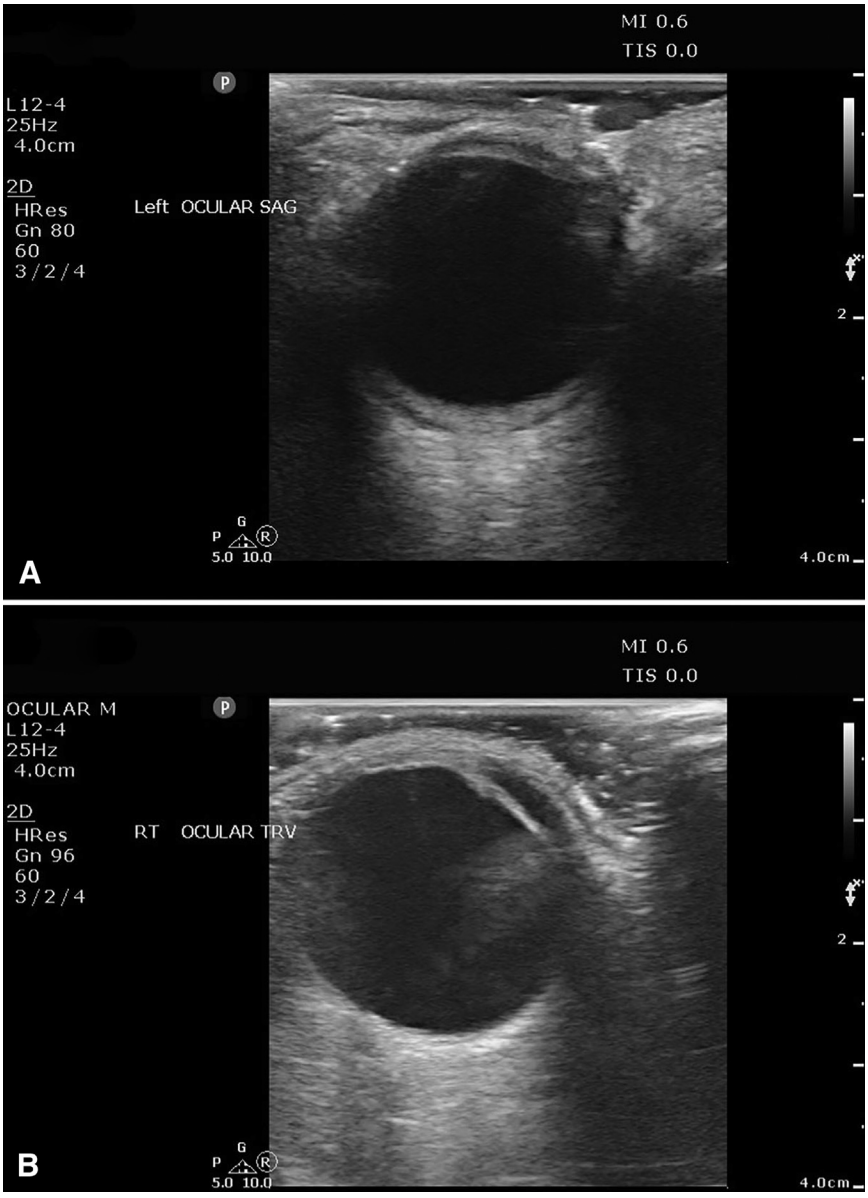


**Figure 2. (A) Sagittal B-mode ultrasound of the left eye showing diffuse globe thickening and fluid in the Tenon's space. (B) Transverse B-mode ultrasound of the normal right eye.**

described the sensation of flashers in the left eye and a central scotoma.

On examination, the patient had a visual acuity of 20/400 in the left eye and 20/20 in the right eye. His lids and lashes were normal. He had no proptosis. The pupils were equal, round and reactive at 4 mm without photophobia with both direct and consensual light. He was noted to have diffuse conjunctival injection with perilimbal sparing and scleral edema (Figure 1). The remainder of his physical examination was unremarkable. POCUS of both eyes was performed in the ED using a Philips Sparq (Bothell, WA) ultrasound machine with a L10–5 MHz transducer in sagittal and transverse orientations through full range of motion. On POCUS evaluation the patient had no evidence of a retinal detachment or vitreous hemorrhage. He was noted to have diffuse thickening of the globe wall in the symptomatic eye with a thin layer of fluid posterior to the globe and mild enlargement of the optic nerve sheath diameter (Figure 2).

On subsequent ophthalmology evaluation, the patient was noted to have subretinal fluid on fundoscopic examination. Ocular coherence tomography was performed demonstrating a focal area of increased fundal thickness with subretinal fluid (Figure 3). He was ultimately diagnosed with posterior scleritis and initiated on prednisone 60 mg, which was tapered over several weeks. By 6 weeks, his vision improved to 20/20 with minimal, residual left eye pain.

## DISCUSSION

Posterior scleritis is an inflammatory process affecting the sclera or adjacent vasculature posterior to the ora serrata and that accounts for 10–25% of all cases of scleritis (4). Approximately 50% of cases of posterior scleritis are associated with systemic autoimmune or inflammatory disease states, such as rheumatoid arthritis, systemic lupus erythematosus, granulomatous polyangiitis, inflammatory bowel disease, polyarteritis nodosa and relapsing polychondritis, or infectious etiologies, such as herpes simplex virus, syphilis, tuberculosis, and Lyme disease (5,6).

Because of the diversity of clinical manifestations, posterior scleritis is a challenging diagnosis to make, even for ophthalmologists (7). Patients present with dull, boring, ocular or periocular pain preventing sleep and often associated with visual loss (5). Posterior scleritis may be accompanied by anterior scleritis, resulting in scleral edema or violaceous redness of the eye. Fundoscopic examination may reveal a variety of findings, including choroidal folds or detachment, disc or macular

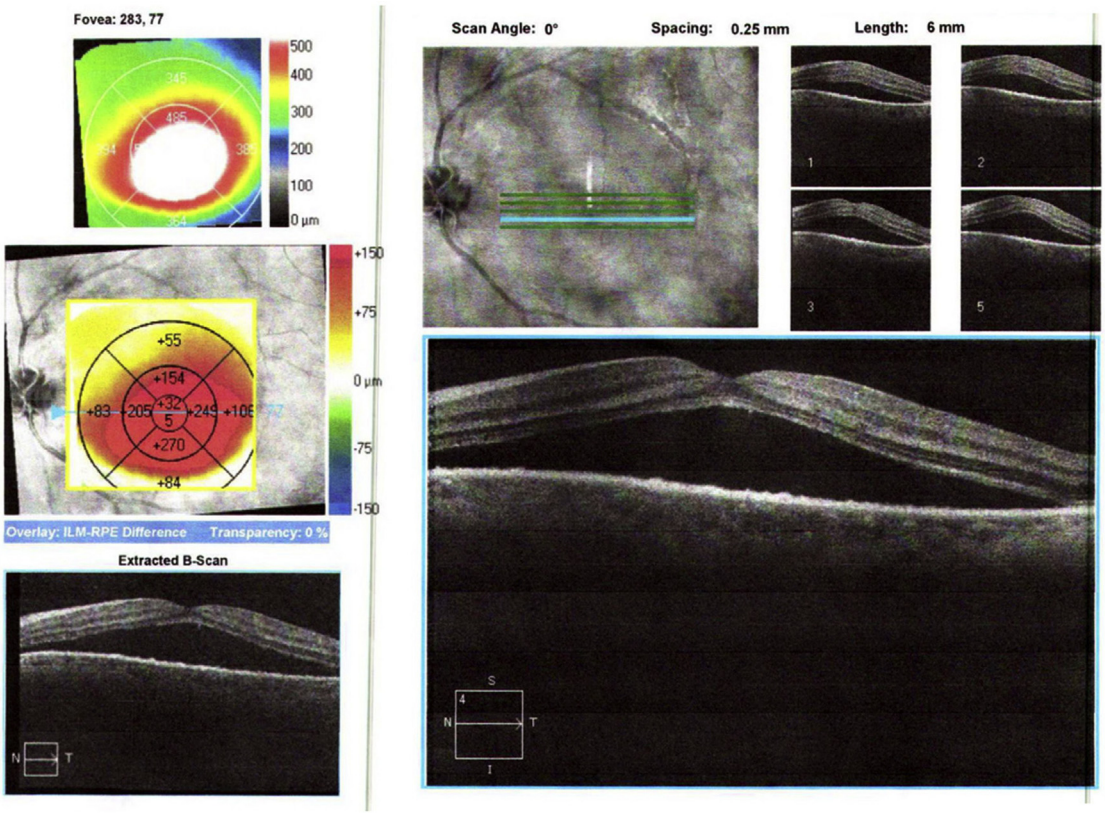


**Figure 3. Ocular coherence tomography showing macular thickening and subretinal fluid at the fovea.**

edema, uveitis, retinal vasculitis, and localized retinal detachment (7,8).

The complications of posterior scleritis vary considerably from eye pain to visual loss because of inflammation of the optic disc and sclera causing macular edema or exudative retinal detachments (9,10). Visual loss is the final common pathway if left untreated. Early diagnosis by front-line physicians and ophthalmologists is important in preventing permanent visual loss.

The workup for suspected cases of posterior scleritis typically involves a combination of clinical findings with imaging and laboratory evaluation. B-mode ultrasound is the tool of choice for making the diagnosis of posterior scleritis.

Sonographically, the normal eye appears as an anechoic globe with thin, echogenic walls. The wall of the globe posterior to the ciliary complex itself is composed of the retina, choroid and sclera, which sonographically appear as a singular, thin wall. The posterior globe from the limbus to the optic nerve is covered by Tenon's sheath and separates the eye from the central orbital fat. The inner aspect of Tenon's capsule is

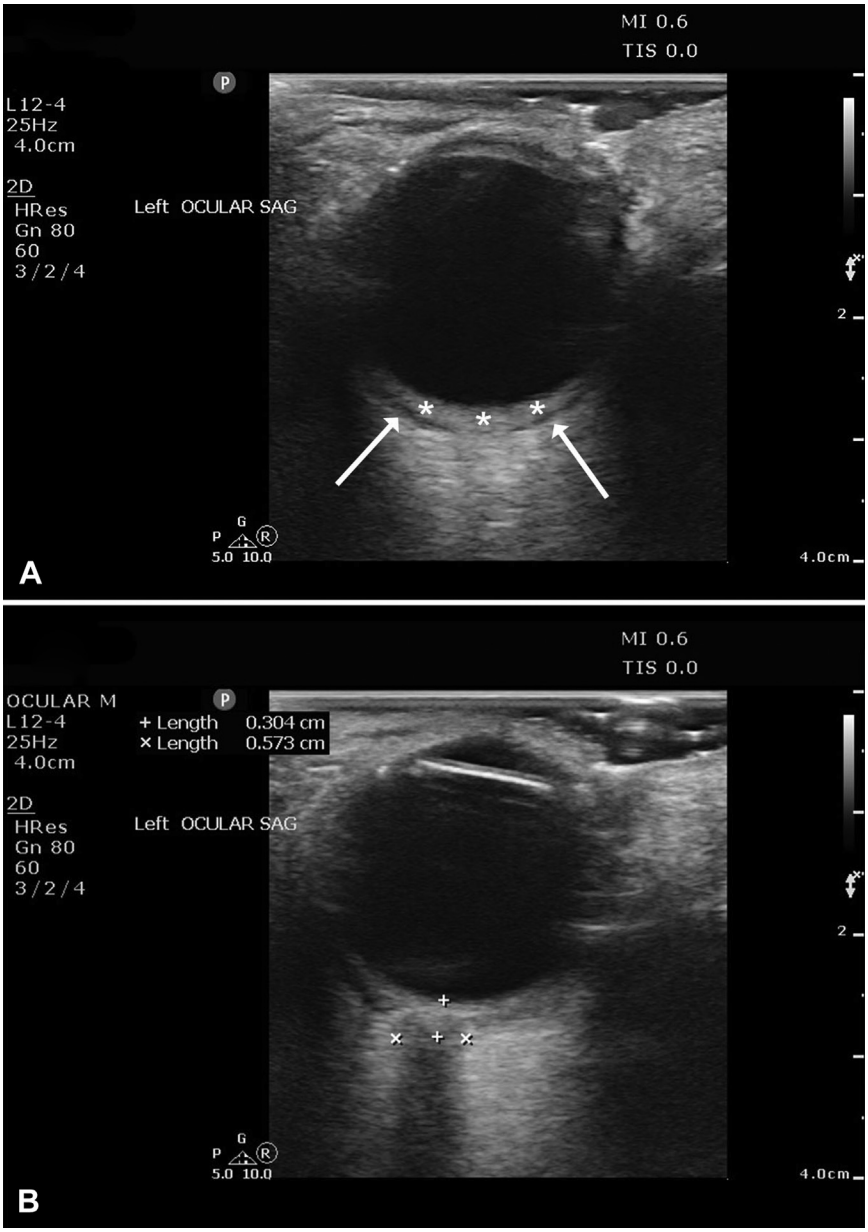


**Figure 4. Sagittal B-mode ultrasound showing findings of posterior scleritis. (A) Diffuse thickening of posterior wall of the globe (*) and fluid in Tenon's space (arrow). (B) Mild distension of the optic nerve sheath diameter measured 3 mm posterior to the optic disc.**

separated from the outer surface of the sclera by a potential space known as Tenon's space, which is not visualized sonographically in the normal eye (11).

The most common ultrasound finding in posterior scleritis is thickening of the posterior wall of the globe >2 mm (10). In addition, patients with posterior scleritis will commonly have fluid in Tenon's space giving rise to the characteristic "T-sign" (Figure 4) (12). Other ultrasound findings include distension of the optic nerve sheath, retinal detachment, and scleral nodules (10,12).

The initial laboratory workup for posterior scleritis should focus on identifying infectious or systemic inflammatory conditions. Inflammatory markers should include a complete blood cell count, erythrocyte sedimentation rate, and C-reactive protein levels. Additional rheumatologic markers include rheumatoid factor, anti–cyclic citrullinated peptide, antinuclear antibodies, antineutrophil cytoplasmic antibodies, human leukocyte antigen B27, C3/C4, anti-dsDNA, Ro, La, and Sm. Markers for infectious processes can also often obtained, and may include serologies for syphilis, tuberculosis, HIV, and Lyme disease.

The initial treatment of posterior scleritis typically involves inflammatory suppression with systemic nonsteroidal anti-inflammatory drugs (5,6). For patients with visual loss, systemic corticosteroids are the mainstay treatment of noninfectious posterior scleritis (10). Typical dosing is prednisone 1 mg/kg/day tapered over several weeks (5). In the absence of treatment response or where corticosteroids are not advised, ophthalmologists have used additional anti-inflammatory or immunomodulating agents in the treatment of posterior scleritis.

## WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

Posterior scleritis is an uncommon presentation of the acutely painful and red eye. However, it carries the potential for significant visual impairment when the diagnosis is missed or delayed. POCUS findings of posterior wall thickening and fluid in the Tenon's space can aid the front-line physician in making the diagnosis of posterior scleritis allowing earlier initiation of appropriate therapy and follow-up.

## REFERENCES


1. Shinar Z, Chan L, Orlinsky M. Use of ocular ultrasound for the evaluation of retinal detachment. J Emerg Med 2011;40:53–7.
2. Kimberly HH, Shah S, Marill K, Noble V. Correlation of optic nerve sheath diameter with direct measurement of intracranial pressure. Acad Emerg Med 2008;15:201–4.
3. Stone MB. Ultrasound diagnosis of papilledema and increased intracranial pressure in pseudotumor cerebri. Am J Emerg Med 2009;27:376.e1-2.
4. Sielert LA, Harris AR, Pyun JM, Campell BJ, Swan RT. Posterior scelritis. Exp Rev Opthalmol 2016;11:475–84.
5. Rifkin LM. Posterior scleritis: a diagnostic challenge. Rev Ophthalmol 2018;25:50–2.
6. Jabs DA, Munda A, Dunn JP, Marsh MJ. Episcleritis and scleritis: clinical features and treatment results. Am J Opthalmol 2000;130:469–76.
7. Biswas J, Mittal S, Ganesh SK, Shetty NS, Gopal L. Posterior scleritis: clinical profile and imaging characteristics. Indian J Ophthalmol 1998;46:195–202.
8. Özdek SC, Gürelik G, Hasanreisolu B. An atypical posterior scleritis case: a diagnostic challenge. Retina 2001;21:371–3.
9. Keino H, Watanab T, Taki W, Nakashima C, Okada AA. Clinical features and visual outcomes of Japanese patients with posterior scleritis. Br J Opthalmol 2010;94:1459–63.
10. McCluskey PJ, Watson PG, Lightman S, Haybittle J, Restori M, Branley M. Posterior scleritis: clinical features, systemic associations, and outcomes in a large series of patients. Ophthalmology 1999;106:2380–6.
11. Canavan KS, Dark A, Garrioch MA. Sub-Tenon's administration of local anesthetic: a review of the technique. Br J Anaesth 2003;90:787–93.
12. Lavric A, Gonzalez-Lopez JJ, Majumder PD, Bansal N, Biswas J, Pavesio C, Agrawal R. Posterior scleritis: analysis of epidemiology, clinical factors, and risk of recurrence in a cohort of 114 patients. Ocul Immunol Inflamm 2016;24:6–15.