Using Point-of-Care Ultrasound for Early Identification of Central Retinal Artery Occlusion

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Abstract
Central Retinal Artery Occlusion (CRAO) is the partial or complete blockage of the central retinal artery presenting as acute painless monocular vision loss with increased risk in those with cardiovascular disease. Diagnosis of CRAO requires a dilated fundoscopic exam performed by an Ophthalmologist. In resource limited hospitals, access to these expertise and resources may be difficult. Early recognition of CRAO in the emergency department (ED) can lead to reduced negative consequences and reduced cost to healthcare. Here we present a case using Point-of-Care Ultrasound (POCUS) to identify CRAO in a patient.

Keywords
Case report, Central retinal artery occlusion, Point-of-care ultrasound, Early diagnosis, Vision loss

Introduction
Acute vision loss at presentation in the ED can progress to blindness or severe visual impairment. CRAO is the partial or complete blockage of the central retinal artery that presents as painless monocular vision loss [1]. Risk factors of CRAO are similar to those of cardiovascular or stroke risk factors related to thromboembolic disease, including hypertension, cardiac valvular disease, and diabetes [2]. The most common cause of CRAO is by an embolus from the aortic arch, ipsilateral carotid artery, or heart [3]. This can result in vision loss, rapid cell damage, and retinal hypoperfusion [4]. Dilated fundoscopic exam is the standard assessment for diagnosing diseases related to painless vision loss. However, diagnostic tools of that nature are limited by availability of specialists needed to complete the exam at a community hospital.

POCUS can be used as a cost-effective, noninvasive diagnostic tool to accurately diagnose CRAO in patients presenting to the ED.

Case Report
A 65-year-old woman presented to the ED with moderate right eye peripheral vision loss with onset 3 days prior to arrival. At admission, the patient had normal ocular motility. She has a prominent past medical history of hypertension, hypercholesterolemia, and diabetes mellitus. She was originally evaluated for posterior circulation infarct due to the loss of vision in her eye. The non-contrast computed tomography (CT) of the head showed no evidence of intracranial hemorrhage or infarct. An electrocardiogram was performed showing mild bradycardia. Neurology and cardiology consultants were performed in the ED and the patient was given aspirin 325 mg. The patient was admitted to the hospital with the diagnosis of CRAO and sent to the Intensive care unit for closer observation.

One day after presenting to the ED the patient received a magnetic resonance imaging of the brain showing no evidence of any acute infarct or intracranial pathology. After 2 days in the ICU, the ICU Attending performed a POCUS on the patient’s eye using a high frequency linear ray probe. There were no findings of vitreous hemorrhage or detachment and no findings of retinal detachment. The POCUS showed an irregular optic nerve sheath measuring larger than 5 millimeters (Figure 1). The findings were consistent with CRAO.
only a direct fundoscopy [10]. One retrospective study shows that the thrombus was directly visualized using a 
dilated fundoscopic exam only 11% of the time in CRAO 
patients [11]. Thus, highlighting the lack of reliability 
of fundoscopic exams in diagnosing CRAO. A review of 
the diagnostic value of POCUS for CRAO found a high 
interobserver agreement (Chohen’s kappa 0.98) and 
albeit small, studies determined a strong specificity 
(100%) and sensitivity (83%) for POCUS reliability [4,9-
12].

Prompt recognition of CRAO is critical for positive 
outcomes. Previous case studies show that rapid 
POCUS can be used as an accurate reliable tool to 
diagnose CRAO [11-13]. Once diagnosed, specialists in 
ophthalmology and neurology can help determine the 
best course of treatment such as intravenous tissue 
plasminogen activator (tPA) [14]. Intravenous tPA, a 
therapy used to treat acute ischemic strokes, requires 
onset of symptoms within a 4.5-hour window leading 
to limited patient enrollment. However, it has been 
shown to improve long-term outcomes [15]. One meta-
analysis of observational studies found that in patients 
diagnosed with acute CRAO, thrombolysis drug therapy 
resulted in a 50% recovery in patients who qualified for 
treatment [16].

In our patient case, she was referred to the ER by the 
ophthalmologist for CRAO. A fluorescein angiography 
was not performed nor was an ESR or CRP level obtained 
for the patient because of the presumed diagnosis of 
CRAO prior to coming into the ED. Intravenous tPA was 
not administered because the patient failed to meet 
inclusion criteria due to the onset of symptoms being 
3 days prior [17]. POCUS was not performed in the ED 
due to availability and familiarity. The evidence found in 
the POCUS indicates that the patients can be accurately 
diagnosed with CRAO in the ED allowing quicker 
intervention in the absence of ophthalmology service.

Discussion

CRAO is a medical emergency, presenting as painless 
vision loss, which can lead to permanent vision loss 
or impairment. POCUS is an effective, cost-efficient 
tool to accurately evaluate ocular pathology in the 
ER without the need for costly diagnostic tests. One 
meta-analysis reported that practitioners can utilize 
POCUS as a helpful and sensitive diagnostic tool for 
ocular emergencies [5]. This tool can help differentiate 
emergency ophthalmologic emergencies from those 
that can be managed as outpatients [6].

The efficacy of POCUS to diagnose various ocular 
emergencies has been described in several cases 
involving retinal detachment, vitreous hemorrhage, 
and vitreous detachment with high sensitivity (96.9%) 
and specificity (88.1%) [7]. POCUS can aid in the 
diagnosis of patients with CRAO through the detection 
of a hyperechoic object known as a “spot sign” [8]. A 
prospective study found that of 12 patients diagnosed 
with embolic CRAO, 10 had a visible “spot sign” using 
sonographic assessment [9]. Direct fundoscopy 
has previously been used as the primary diagnostic 
tool for CRAO [4]. Many physicians cannot reliably 
visualize ocular abnormalities leading to a decrease 
in confidence for the ability to diagnose CRAO using 
Figure 1: POCUS image of the right eye using a high frequency linear ray probe. Displaying a clot (red arrow).

Patient was diagnosed with bilateral severe carotid 
estenosis based on the ultrasound findings. The carotid 
estenosis was worse on the right side with no evidence of 
a cardiac source of embolism. The patient underwent a 
carotid endarterectomy with patch right intraoperative 
shunt and was not expected to have improvement 
in right eye vision. Patient was sent home with new 
medications including aspirin 325 mg once a day and 
apixaban 5 mg two times a day.

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Conclusion

In small hospitals with limited resources, POCUS is 
a reliable, cost-effective alternative tool to diagnose 
patients with CRAO. Therapies that can improve long-
term outcomes for patients require an early diagnosis. 
Our case report highlights the ability to utilize POCUS 
as an alternative diagnostic method to decrease time 
to definitive therapy in the absence of ophthalmology service.

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Financial Disclosure

The authors declare that they have no relevant financial interests.

Ethical Approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed Consent

Written consent has been obtained from the patient for publication of the case report and accompanying images.

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