



Point-of-care ultrasound facilitated Optic Nerve Sheath Diameter for discernment of ischemic vs. hemorrhagic stroke.

An Ongoing Study in Zambia.

A Case Study by:
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“Optic nerve sheath diameter (ONSD) measurements with ultrasound have the potential to truly revolutionize the management of stroke in low-resource settings, where no CT scan is available.”

Introduction

Low- and middle-income countries (LMICs) shoulder the vast majority of global stroke burden, including overall stroke prevalence and stroke mortality.¹ Computed tomography (CT) of the brain is a critical diagnostic tool for discerning between the 2 major stroke types, ischemic and hemorrhagic, which differ significantly in their management. Unfortunately, access to CT scan is often very limited—or entirely absent—for many patients living in LMICs. The optic nerve sheath, which lies behind the eye and is continuous with the intracranial cerebrospinal fluid, can be readily measured using point-of-care ultrasound (POCUS) and has been shown to have increased diameter in the setting of increased intracranial pressure.² An ongoing study in Zambia is evaluating whether optic nerve sheath diameter (ONSD) can be used to discern between hemorrhagic and ischemic stroke types—which, if positive, could potentially alter stroke management in LMICs, where no CT scan is available.

Case Example

I was scanning with one of my 3rd-year Family Medicine resident physicians in the admission ward of Zambia’s largest tertiary care center, University Teaching Hospital. We had just started data collection for a study to evaluate the utility of ONSD, as measured by POCUS, in discerning between hemorrhagic and ischemic stroke types. While this hospital had a working CT scanner available for its stroke patients, most government hospitals in Zambia do not. Indeed, throughout my time working as a physician in Zambia, only a minority of my stroke patients ever underwent CT scanning.

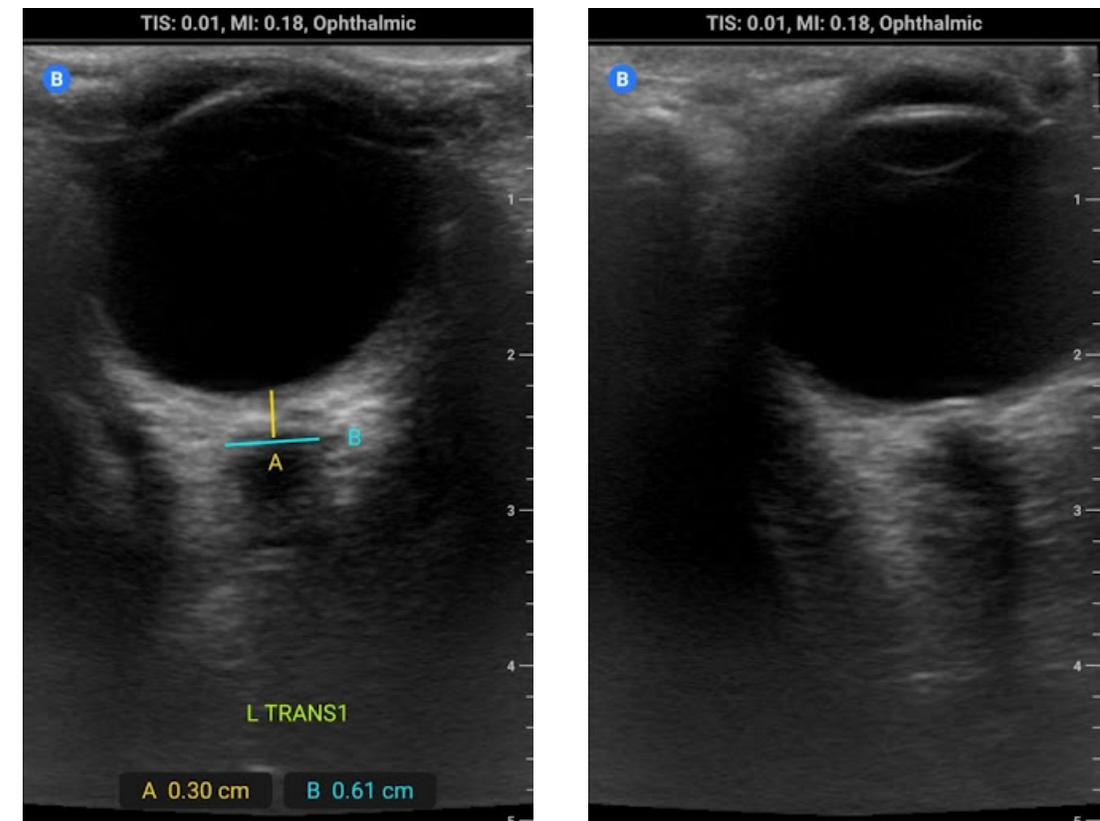
Upon placing the Butterfly device over the patient’s closed eyelid, the resident remarked “this looks wide to me.” I took a closer look. “Yes I agree. Let’s try the long axis view.” In fact, the majority of ONSD measurements on this patient were measuring wide.

Something else caught my resident’s eye. “Doc, could this be optic disc elevation?” I took a closer look, feeling pretty skeptical. Optic disc elevation, the ultrasound equivalent of optic disc swelling or papilledema, is an area of ongoing research, but some initial data suggests it may outperform ONSD in detecting increased intracranial pressure.³ While our study was more focused on ONSD, we had agreed that we would also look for optic disc elevation.

I took a close look at the Butterfly images. I couldn't believe my eyes.
“Yes, that is optic disc elevation for sure. Great find!”

At this point in our study, we find ourselves in the unique position of finding these positive findings—such as wide ONSD and elevated optic disc—but there's not enough research yet for us to be able to apply them to patient management. But, as we collect more data on more stroke patients here in Zambia, hopefully that time will come soon.

Sample Imaging Exam



What does this teach us?

POCUS has enormous potential in LMICs, where patients often have limited imaging options. Novel applications—including optic ultrasound as being investigated in this study—have the potential to transform healthcare diagnostics in LMICs globally.

Introduction

1. Lanas F, Seron P. Facing the stroke burden worldwide. *Lancet* 2021;9:e236. [https://doi.org/10.1016/S2214-109X\(20\)30520-9](https://doi.org/10.1016/S2214-109X(20)30520-9)
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The Author



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Matthew S. Haldeman is a Family Medicine physician currently working with Seed Global Health to help build the specialty of Family Medicine in Zambia by serving as a faculty at the country's first residency program in that specialty. He graduated from The Ohio State School of Medicine in 2011 and completed his residency at Self Regional Family Medicine Residency in South Carolina in 2014. He subsequently completed a fellowship in Global Health at the University of South Carolina in 2019, and he completed fellowship-level training in Point-of-Care Ultrasound that same year. His interests include ultrasound in Global Health, tropical medicine, and medical education.