Clinical Ophthalmic Echography
Clinical Ophthalmic Echography

A Case Study Approach

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Who Really Needs Ultrasound?

There are numerous clinical applications of ocular ultrasound. However, many clinicians complete their training with minimal exposure to echography beyond that for biometry and do not appreciate the value of this technology in their practices. The occasional patient in the general eye practice who is perceived to need an imaging study is referred for computer tomography (CT) or magnetic resonance imaging (MRI) scanning, which are readily accessible in developed countries. The potpourri of diagnostic imaging modalities with insurance coverage is potentially subject to overuse. It is tempting to order MRI scans for headaches, CT scans for pains around the eye, and carotid Doppler duplex scanning for vision disturbances. In many cases, a careful history and physical examination combined with the use of ultrasound can correctly diagnose the problem without the need for more expensive studies.

The general ophthalmologist sees patients on a daily basis who have symptoms related to the eyes or paraocular structures that can be clarified by the use of ultrasound. Common complaints encountered in the clinic include pain in and around the eye; double vision; various forms of flashes, floaters, and geometric shapes such as curves, shadows, and scotomata; bulging eyes; and lumps and bumps around the eyes. Also, ocular examination may reveal problems of which the patient may not be aware, such as iris and posterior segment lesions, elevated optic nerve heads, proptosis, and subtle ptosis.

It is relatively easy in the course of a busy office schedule to put the ultrasound probe on the patient’s eye and in a few seconds detect an abnormality that can precisely diagnose the problem or direct the subsequent diagnostic workup. It is not unusual for a patient who has been seen by other medical practitioners with complaints that have been treated with various types of eye drops to be correctly diagnosed by ultrasound. The convenience to the patient of this modality is a major advantage over having to reschedule him/her for expensive radiologic testing. The cost effectiveness of ophthalmic echography is significant compared to other imaging studies. The average cost of a brain MRI is approximately US $1500, brain CT costs approximately US $800, and carotid Doppler costs approximately US $600. In contrast, the average cost of a diagnostic ophthalmic ultrasound examination is about US $300 based on the latest Current Procedural Terminology (CPT®) code 76510 for combined A- and B-scan examination. This cost advantage is illustrated by the following case.
Case Study 1
Optic Nerve Drusen

AI was a 10-year-old boy who complained of headaches severe enough to keep him home from school on several occasions for several months. He was taken to his pediatrician and then referred to a comprehensive ophthalmologist, who felt the optic discs were elevated. He was then referred to a neurologist who hospitalized the child and did a complete neurological examination, ordered a CT scan and then an MRI scan and subsequently a cerebral angiogram, and performed a lumbar puncture. This US $20,000 workup proved to be negative for central nervous system pathology. He ultimately was referred for echography, where B-scan quickly demonstrated buried calcified drusen as the cause for the disc irregularity (Fig. 1). A-scan measured the diameter of the optic nerves in the orbit to be within normal limits.

This book uses a case study approach to illustrate how useful echography can be in a typical ophthalmologist’s or optometrist’s office. This technology gives the clinician another dimension of diagnostic capability. It provides the ability to visualize the posterior segment otherwise obscured by a dense cataract or cloudy cornea. It enables examination of the retrobulbar and orbital structures in a patient presenting with pain or pressure around the eye. It facilitates analysis of visible lesions in the fundus on a level approximating histopathological tissue slices. It fills a niche among all the other powerful imaging technologies by providing information not otherwise obtainable. The clinician proficient in echography experiences a paradigm shift from frustration and inadequacy in dealing with certain types of eye problems to satisfaction in identifying and properly addressing the issue.

The quality of an echographic study is highly examiner dependent so it is essential that the practitioner receive hands-on training with someone skilled in echographic techniques. This is important for the B-scan, but proper use of the A-scan greatly expands one’s diagnostic capabilities. The vertical spikes of this modality seem foreign compared to the recognizable anatomic sections of the eye displayed on the B-scan screen, but once understood they increase the diagnostic capacity of the examiner. Many people equate ophthalmic echography with the B-scan unit, which may or may not have a vector A-scan tracing at the bottom of the screen. The diagnostic capability of an instrument that has a separate dedicated A-scan probe is far superior to the single A/B probes. There are excellent combined A- and B-diagnostic echography units on the market that include biometric capability and range in cost from US $20,000 up to US $50,000 for those including an ultrasound biomicroscope (UBM).

A- and B-scan techniques are often used during the same examination for evaluation of the eye and orbit. B-scan is useful for intraocular processes because of its ability to display shape and anatomical relationship to other structures. It is very sensitive to the presence of high reflective material, such as intraocular foreign bodies of various types, and in detecting calcium, such as seen in optic nerve head drusen. Its value in the orbit has largely been supplanted by the continually evolving resolution of computer-linked radiologic technology, such as MRI, CT, and positron emission tomography (PET) scanning. However, B-scan remains clinically useful in the detection of orbital processes, such as
anterior orbital tumors, subtenon’s infiltration by inflammatory or malignant cells, tendon thickening in myositis, and in displaying enlargement of the superior ophthalmic vein in various congestive disorders, such as carotid cavernous or other arteriovenous (AV) orbital fistulas.

The A-scan, on the other hand, fills several orbital niches inadequately covered by B-scan and radiologic scanning techniques. As stated in the American Academy of Ophthalmology Basic and Clinical Science Course, “standardized A-scan is much less aesthetically attractive to the beginner and is more difficult to perform. However, it potentially conveys much more diagnostic information than the B-scan.” Its ability to quantitate orbital structures, such as extraocular muscle and optic nerve thickness, can provide very important information not obtainable by other modalities. It is useful in the paraocular examination in such conditions as dacryoadenitis by providing measurements of the lacrimal gland and analysis of its internal structure. It can also provide information about the paranasal sinuses, nasolacrimal system, posterior sclera, and subtenon’s space. It is able to provide information about the internal structure of intraocular and orbital tumors that is often highly correlated to the pathological diagnosis.

In the setting of a general ophthalmologic or optometric practice, there are many instances where echography is extremely useful and some in which it can make a major impact on the evaluation and treatment of the patient. Echography is an essential tool and unequalled by other imaging technology in the evaluation of the globe when opaque media precludes an optical view of the intraocular structures. Such abnormalities as corneal opacities, cells in the anterior chamber, lens opacities, and vitreous hemorrhage or inflammation interfere with adequate visualization by the direct or indirect ophthalmoscope. Ancillary tests, such as fluorescein angiography and optical coherence tomography (OCT), are useless in such conditions. The unique ability of high-frequency sound waves to pass through soft tissues without hindrance provides an acoustic window where light is not able to penetrate. The following case illustrates the ability of echography to correctly diagnose a disease process resulting in the application of appropriate therapy.

Fig. 1. Small calcified optic nerve drusen (arrow)
MA is a 75-year-old woman who noted the sudden onset of a severe headache with concurrent loss of vision in her right eye. Her left eye was legally blind at the 20/200 level from preexisting macular degeneration, but she had been able to read and watch TV with her 20/40 right eye. She presented at her local emergency room, where a CT scan was performed because of the headache. It was read as normal by the radiologist.

The on-call ophthalmologist who was covering the emergency room that day saw her. He noted vision of bare light perception in her right eye and 20/200 in her left eye. Slit-lamp examination found 2+ to 3+ corneal edema and a poorly seen anterior chamber with 1+ cells and a cataractous lens. Her intraocular pressure was 35 mm Hg left eye (OS) and 23 mm Hg right eye (OD). Gonioscopy was difficult because of the corneal edema, but his impression was a probable closed angle; however, the sudden visual loss was suspicious for ocular ischemia with secondary anterior segment changes. She was started on topical steroids and pressure-lowering agents.

She was seen in his office the next day with markedly reduced pain and a reduction in intraocular pressure to 20 mm Hg. However, her vision remained at the light perception level and she had persistent corneal edema, anterior chamber reaction, and lens opacity. The fundus could not be visualized. He performed a B-scan in his office that revealed a normal posterior segment with a clear vitreous cavity and an attached retina.

She was referred to the neuro-ophthalmology department at the university medical center because of the uncertainty of the diagnosis. A- and B-scan echography was performed and an immersion scan of the anterior segment revealed an intumescent lens and a shallow anterior chamber (Fig. 2). Cataract surgery was performed to improve the visual acuity and reduce the angle closure. The intraocular pressure returned to normal without medications and the corneal edema slowly resolved with improvement of visual acuity to 20/50.

The most common media opacity responsible for reduced vision is opacification of the crystalline lens. Echography is essential in enabling modern cataract surgery both by measuring the axial length of the eye for intraocular lens calculations and to evaluate the posterior pole when the cataract is so dense that the fundus cannot be visualized. Such pathology as vitreous opacities, retinal detachment, and intraocular tumors can be detected prior to lens removal.
Fig. 2. Top: A scan of lens (vertical arrows). Bottom left: Immersion B scan (10MHz probe) of intumescent cataractous lens (horizontal arrows). Bottom right: High frequency immersion scan (20MHz) of lens (arrows)
Case Study 3
Ciliary Body Melanoma and Sector Cataract

MH is a 73-year-old man who presented to his ophthalmologist with the complaint of reduced vision in his left eye over several months. Examination found visual acuity OD of 20/30 and OS of 20/50. Slit-lamp examination showed mild nuclear sclerosis in both lenses and a dense sectorial cortical cataract in the superior nasal quadrant of the left lens. The fundus could not be seen in this area due to the lens opacity.

B scan showed part of a very peripheral lesion in the vicinity of the superior nasal ciliary body. Immersion scanning confirmed the presence of a ciliary body mass most consistent with a malignant melanoma (Fig. 3). The patient was advised not to undergo cataract surgery because of the potential for disseminating tumor cells via surgical manipulation. It was elected to observe the tumor for growth with serial echography every 3 to 4 months.

Solid and cystic lesions of the ciliary body and iris may go undetected until discovered on a slit-lamp examination as a bulge in the iris. Transillumination can sometimes be helpful in this setting, but the results of this test are often equivocal. This area is best evaluated by an immersion B-scan. The standard 10-MHz probe is adequate to image some of these lesions, but 20 or 50 MHz (UBM) better characterizes smaller ones.

![Fig. 3. B-scan of ciliary body melanoma (vertical arrow) in contact with crystalline lens (horizontal arrow)](image)
NG is a 29-year-old woman who was noted on a routine eye examination to have a pigmented lesion of her left temporal iris root. The same optometrist had checked her in the prior year and this finding had not been noted at that time. Gonioscopy revealed focal involvement of the ciliary body but the adjacent angle was normal. The lesion seemed solid on transillumination.

Immersion scanning using a 20-MHz probe revealed a solid lesion of the anterior ciliary body (Fig. 4). It measured 1.6 mm by 1.5 mm. The finding of a probable ciliary body melanoma was discussed with the patient and she elected to observe it for growth with repeat echography every 4 to 6 months.

Iris and ciliary body cysts are more common than solid lesions and are easily diagnosed on immersion scanning (Fig. 5). Multicystic lesions are not uncommon. It is important to differentiate them from tumors such as melanoma.

The correct diagnosis of anterior segment problems with timely therapy can be facilitated by echographic techniques.
TA is a 62-year-old diabetic with a history of proliferative retinopathy. His right eye had become phthisical after unsuccessful retinal detachment surgery and the vision in his left eye had gradually decreased to the 20/200 level due to a combination of macular pathology and cataract formation. He underwent cataract surgery with the implantation of an anterior chamber intraocular lens implant (IOL) because of zonular dehiscence secondary to previous vitrectomy. His visual acuity improved to the 20/60 level, but he awoke on a Friday morning with a severe headache and marked reduction of his vision.

His ophthalmologist was out of town and a retinal specialist associated with the same group eventually saw him in the afternoon. Examination found vision OS of 20/400, intraocular pressure of 42, and “iris bombe” with iris bulging around the IOL in spite of an apparently patent surgical iridotomy. The patient was urgently referred for echography.

Immersion B-scan with a 20-MHz probe and a scleral shell filled with methylcellulose demonstrated an anterior chamber IOL with bulging of the iris almost to the cornea nasally and temporally, but otherwise the anterior chamber was deep (Fig. 6). This was consistent with trapped pockets of aqueous. A yttrium aluminum garnet (YAG) iridotomy was performed for three spots in the areas of the iris bulge with almost immediate flattening of the iris and relief of the patient’s headache. Intraocular pressure was measured at 34 mm and had decreased to 9 mm by the next morning.

Echography is equally important in the evaluation of visible fundus lesions. A-scan provides the unique capacity to characterize the internal structure of intraocular tumors that is highly correlated to the tissue characteristics of the lesion. The quantitative (spike height and regularity) and kinetic (rapid spike movement) criteria described by Ossoinig\(^2\) provide high specificity and sensitivity in evaluation of ocular lesions.

**Fig. 6.** Iris (large arrow) bulging around anterior chamber intraocular lens implant (small arrow)
MO is a 54-year-old woman who noted a shadow increasing over several months in the lower part of her field of vision in the left eye. She presented to her optometrist, who noted vision OD of 20/20 and OS of 20/30 with some distortion. Fundus examination of the left eye found a lightly pigmented lesion posterior to the superior equator. A visual field examination showed an inferior defect that extended into the lower part of central fixation.

B-scan revealed a solid lesion just above the left macula with basal dimension measurements of 6.2 mm circumferentially and 7.1 mm radially with 2+ spontaneous internal vascularity. A-scan measured thickness of the lesion to be 6.24 mm with medium and regular internal reflectivity (Fig. 7).

These findings were highly consistent with a choroidal melanoma and the patient was referred for radioactive plaque therapy after a systemic evaluation for metastatic melanoma was negative.

The quantitative capability of the A-scan has become essential in the management of intraocular tumors. The last 20 years has witnessed the transition from enucleation as the procedure of choice in the management of intraocular malignant melanoma to observation and radiation in cases of documented growth. A-scan measurements of the thickness of intraocular lesions are integral to this current management paradigm.

Fig. 7. A-scan of choroidal melanoma. Tumor surface indicated by first arrow and sclera by second arrow
Case Study 7
Small Choroidal Melanoma

GH is a 47-year-old woman who was seen by an ophthalmologist for a routine eye examination. She was found to have an elevated pigmented lesion in her temporal fundus on ophthalmoscopy. A fluorescein angiogram was obtained that showed early hyperfluorescence in the late arterial phase with increasing hyperfluorescence in the late venous phase that persisted after 15 minutes.

B-scan revealed a moderately echodense lesion that measured 5.5 mm in circumferential basal dimension and 6.1 mm in radial basal dimension. A-scan demonstrated a medium reflective lesion that measured 2.76 mm in thickness (Fig. 8). Spontaneous vascularity was not detected. The differential diagnosis included a large choroidal nevus or a small malignant melanoma. It was elected to follow her with repeat echography in 4 months. The lesion has been measured at the same thickness and basal dimensions for 2 years with the frequency of examination being extended to one per year.

Echography is an essential tool in the differential diagnosis of intraocular lesions. The echo signal characteristics of the most common choroidal mass lesions are distinctive enough to make an accurate diagnosis in most cases. This list includes malignant melanoma, choroidal hemangioma, metastatic tumors, retinoblastoma, and disease processes that simulate tumors, such as subretinal hemorrhage and disciform scars.

Malignant melanomas are low-to-medium reflective with a regular structure and usually demonstrate spontaneous internal vascularity on A-scan. The B-scan generally demonstrates a dome or mushroom shape (Fig. 9).

Choroidal hemangiomas are medium-to-high reflective with a regular internal structure and do not show spontaneous internal vascularity (Fig. 10).

Metastases to the choroid occur most frequently from primary tumors of the breast in women and the lung in men. Echography shows irregular internal structure with low and high spikes. Spontaneous internal vascularity is usually absent (Fig. 11).

Retinoblastomas are most often found in children at an average age of 2 but have been reported in adults. They are generally calcified, which is readily detectable by echography (Fig. 12).

Subretinal hemorrhage is usually acute in onset and associated with choroidal neovascularization. Echography demonstrates low-to-medium internal reflectivity with regularity of the spikes due to the presence of liquid blood in an acute event versus irregularity in a more chronic process.
Echography is an important tool in evaluation of the retina, which may be hidden by bleeding in the vitreous cavity. Vitreous hemorrhage occurs relatively frequently as a result of neovascularization and vitreoretinal traction in diabetes and other vaso-occlusive disease, such as retinal vein occlusions. It can also occur in patients without underlying vascular disease as a result of traction on the retina in posterior vitreous detachment (PVD). Ultrasound is able to demonstrate an elevated retinal tear or focal retinal detachment that would otherwise go undetected and untreated with the possibility of evolution into a significant retinal detachment.

**Fig. 11.** A-scan of metastatic tumor of the choroid. Tumor surface indicated by *first arrow* and sclera by *second arrow* with gliotic changes in the subretinal space and choroid (Fig. 13).

**Fig. 12.** B-scan of calcium clumps within retinoblastoma (*arrow*)
Fig. 13. A-scan of disciform scar (vertical arrows)
NR is a 52-year-old moderately myopic man who noted the onset of flashes of light several weeks prior to presentation at his ophthalmologist’s office. He experienced numerous little black floaters and clouding of his vision in the left eye on the morning of the consultation. Examination found vision 20/20 OD and 20/100 OS. Fundus examination was normal in the right eye and no fundus detail could be observed in the left because of a moderately dense vitreous hemorrhage. The patient was advised to stop taking aspirin products, minimize physical activity, and return for follow-up in 2 weeks. However, he was very bothered by the lack of vision in his left eye and sought a second opinion from a retinal specialist.

B-scan demonstrated a moderately dense vitreous hemorrhage and a total PVD with a focal area of vitreoretinal traction inferio-temporally (Fig. 14). The diagnosis of a flap tear with traction was made and the patient was instructed to elevate his head at night and to return the next day for reexamination. The plan was to treat the tear with laser as soon as the blood cleared enough to allow visualization or plan vitrectomy with endolaser if the blood remained and the retina showed evidence of detaching. By the third day the blood had settled enough to allow placement of laser spots around the tear and the retina remained attached.

Detachment of the vitreous occurs commonly in individuals past the age of 40 and 6% to 15% of patients with symptoms of flashes and floaters with a PVD will experience a retinal tear as part of this process. The average practitioner will usually see at least one patient a day with a PVD. These individuals should be examined with indirect ophthalmoscopy and scleral depression and then followed-up within a few weeks. They can be informed that the floater will become less noticeable over time.

A number of people experience only syneresis of the vitreous gel resulting in one or more floaters without a detachment of the vitreous. They sometimes present with complaints of a floater that can be quite concerning to them. Demonstration of the opacity on B-scan and the explanation that it is nonthreatening to the eye can be reassuring to the patient.

**Fig. 14.** B-scan of vitreoretinal traction (arrow)
Case Study 9
Vitreous Syneresis

BG is a 34-year-old man who noted a “shape like a half-circle” in his vision that bothered him constantly. He related this symptom to his primary care doctor who ordered an MRI scan to eliminate intracranial pathology. The scan was normal and the patient was referred to an ophthalmologist. Examination was unremarkable with visual acuity in both eyes of 20/20 and a normal fundus examination. A posterior vitreous detachment was not detected. B-scan demonstrated a small moderately reflective mobile surface in the vitreous that was consistent with condensation and syneresis (Fig. 15). This was demonstrated to the patient and he was given a copy of a photo for his records. He expressed great relief that “there was nothing seriously wrong with the vision” and soon stopped obsessing about the floater.

Some patients can develop a retinal detachment with no or minimal symptoms of a PVD. They may describe a “curved surface or shape” in the peripheral visual field of one eye. If it is a very shallow detachment, ophthalmoscopic examination may not detect it, whereas B-scan is a very sensitive tool with a high sensitivity level to even a slight separation of the retina from the underlying retinal pigment epithelium.

Fig. 15. B-scan of vitreous condensation and syneresis (small arrow)
Case Study 10
Shallow Retinal Detachment

AH is a 57-year-old Indian woman who presented to an oculoplastic specialist with the complaints of intermittent pain around her left eye. She also mentioned a “curved reflection” noticed intermittently in her upper outer quadrant of vision. Ocular examination including fundus inspection was described as normal. A CT scan was read as normal and she was referred for echography to eliminate myositis or other orbital inflammatory processes.

Orbital A-scan showed only a few low ethmoid sinus signals felt to be most consistent with mild mucous membrane swelling. B-scan detected a shallow inferior nasal retinal detachment (Fig. 16) and she was referred to the retina service for management.

Pain in or around the eyes is one of the most common patient complaints in any ophthalmologic or optometric practice. This symptom is often hard to characterize even after a detailed history is taken and a careful examination is performed. This is especially true if the symptoms are intermittent and not present at the time of the consultation. The practitioner must decide how vigorously to pursue the diagnostic workup. Imaging studies, such as CT and MRI scans, are expensive and often require the patient to take several hours out of a busy schedule to undergo the test. Echography provides a rapid and cost-effective method to efficiently screen for ocular and orbital causes of the pain. Such entities as scleritis, myositis, pseudotumor, superiosteal abscess and hemorrhage, mucocele, sinusitis, optic neuritis, orbital and lacrimal tumors, and dacryoadenitis are readily detectable by echography.

Fig. 16. B-scan of shallow retinal detachment (arrow)
Case Study 11
Dacryoadenitis

MB is a 25-year-old woman who complained of intermittent aching pain around her left eye over a period of several weeks. Examination was unremarkable with only slight tenderness to palpation of the left superior orbit. A CT scan had been ordered by her primary care doctor and was read as normal by the radiologist. A-scan was performed by the ophthalmologist and demonstrated thickening of the left lacrimal gland of 15.45 mm compared to a normal measurement of 13.2 mm for the right gland. Internal reflectivity was medium reflective compared to the higher reflectivity of the right lacrimal gland (Fig. 17). These findings were most consistent with a low-grade dacryoadenitis and she was given a 2-week course of oral antibiotics with resolution of her symptoms. Remeasurement by A-scan showed reduction in size of the gland to 14.3 mm.

Echography is very useful in the evaluation of the optic nerve. The blurred optic disc is encountered relatively commonly in the course of general ophthalmologic or optometric practice. Many normal discs are somewhat irregular in appearance with blurred margins and this can cause concern for the practitioner about a possible intracranial process, especially in the setting of a patient complaining of headaches. Brain tumors are estimated to occur in a very small percentage of patients, about 1 in 1000. However, in a litigatious society such as the United States, many of these individuals are referred for neuroimaging, which usually turns out to be normal. The wasted time and money spent in such defensive medicine is considerable, and adds to the increasing healthcare portion of the national budget.

The ability of A-scan to quantitate the optic nerve thickness is quite helpful in the evaluation of papilledema. It can assist in answering the question

![Fig. 17. Top: A-scan of right lacrimal gland (vertical arrows define the anterior and posterior surface of the gland). Bottom: A-scan of left lacrimal gland (arrows)]
of whether an engorged optic nerve head is due to increased fluid in the nerve sheath, as occurs in pseudotumor cerebri, or the result of solid thickening as seen in glioma, meningioma, or cellular infiltration of the nerve sheaths. B-scan gives a very accurate morphological view of the optic nerve head. It is extremely sensitive to calcium deposits such as optic disc drusen.
Case Study 12
Optic Nerve Drusen

CJ is a 27-year-old woman who had a long history of migraine-like headaches and had noticed an increase in severity and frequency over the past few months. She was seen by her primary care doctor and told, “everything was normal except for mild hypertension.” A low dose of hydrochlorothiazide was started, and she was advised to see her eye doctor to eliminate an ocular cause for her symptoms.

An optometrist examined her eyes and documented 20/20 uncorrected vision in both eyes and intraocular pressure of 16 mm in each eye. Pupil reactions were normal with no afferent pupil defect and confrontation visual fields were full. Slit-lamp examination was unremarkable, but the fundus examination documented some irregularity of the optic nerve heads, especially on the right. No spontaneous venous pulsations were appreciated. Humphrey visual field testing was normal except for possible mild enlargement of the blind spots bilaterally. These findings were discussed with the patient and it was suggested that she undergo further workup.

She was referred to a neurologist for an examination followed by an MRI scan. This showed one or two nonspecific white spots in the paraventricular area, but no evidence of a mass lesion. It was assumed that she probably had pseudotumor cerebri and a lumbar puncture (LP) was performed. The opening pressure was borderline so she was started on diamox. She had a severe post-LP headache for several days afterwards, but did experience some relief from her usual headaches with the diamox. She noted increasing side effects from this medication over the next several months. The nausea and paresthesias became intolerable and she finally stopped the medication. She asked for a second opinion and was referred to a neuro-ophthalmologist. He reviewed the history, examined the optic nerves with ophthalmoscopy, and carefully evaluated the MRI scan. He questioned the diagnosis of pseudotumor cerebri and referred her for diagnostic echography.

A-scan measured the optic nerves to be in a normal range with 2.47 mm OD and 2.5 mm OS (Fig. 18). B-scan showed mild elevation of both discs with small buried calcified drusen bilaterally (Fig. 19). The neuro-ophthalmologist reassured her that she probably had pseudopapilledema and could safely stop taking carbonic anhydrase inhibitors with an annual follow-up examination unless her headaches worsened or new symptoms, such as diplopia, appeared.

Buried optic disc drusen present with disc or peripapillary nerve fiber layer hemorrhage in 2%

Fig. 18. A-scan of optic nerve sheaths (vertical arrows)
Four types of retinal hemorrhages have been described: (1) splinter nerve fiber layer hemorrhages at the disc; (2) hemorrhages of the optic nerve head extending into the vitreous; (3) deep papillary hemorrhages; and (4) deep peripapillary hemorrhages with or without extension into the macula. Tiny calcifications are easily missed on radiologic studies. Echography is more sensitive than routine CT scans in the presence of faint calcium deposition such as with small buried drusen.

Fig. 19. Left: B-scan of calcified optic disc drusen in the right eye (arrow). Right: The left eye (arrow)
SF is a 42-year-old woman who was noted on a routine eye examination to have peripapillary hemorrhage just inferior to her left optic disc. Visual field testing showed a focal arcuate defect superior to the blind spot. A fluorescein angiogram did not reveal any subretinal neovascularization.

B-scan demonstrated a tiny druse buried in the optic nerve head (Fig. 20) that was assumed to be the source of the hemorrhage and the patient was told to follow-up in 4 months unless any symptoms of visual loss or distortion occurred.

Echo spikes from calcium within the nerve substance, such as with calcified drusen, stand out in contrast to the relatively lower reflective nerve parenchyma. The same explanation applies to high reflective material within the optic nerve vasculature as sometimes found in central retinal artery emboli. Sergott and colleagues\textsuperscript{7} reported that 31\% of patients with central retinal artery occlusions were found to have embolic material posterior to the lamina cribrosa on B-scan evaluation with a color Doppler unit. These can also be demonstrated on a standard grayscale B-scan unit.

Fig. 20. B-scan of tiny buried druse (arrow)