ing and bluntly dissecting conjunctiva and Tenon fascia to 3 to 5 mm posterior to the limbus. One of several specially designed sub-Tenon cannula is advanced against bare sclera and along the globe, typically to the point of contact of the hub of the cannula to the eye. The cannulas are advanced to this depth to increase the likelihood that the anesthetic will diffuse sufficiently into the orbit to achieve anesthesia and akinesia.

This “blind” insertion technique is generally considered to be safe because the relatively short length of the cannula is believed to limit the potential for damage to the optic nerve, which is a well-recognized complication of the previously more common technique of retrobulbar injection. Our case offers evidence that a sub-Tenon injection can damage the optic nerve. The contrast between our experience and the standard teaching of the relative safety of sub-Tenon injections motivated us to evaluate the design of some cannulas recommended for sub-Tenon injections. Even a cursory examination made it clear that these cannulas were long enough to cause an optic neuropathy. We believe that sub-Tenon injections are associated with a lower risk of injury to the optic nerve than retrobulbar injections, but the risk of a traumatic optic neuropathy is not eliminated by sub-Tenon injection.

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Detection of Lactate in the Human Vitreous Body Using Proton Magnetic Resonance Spectroscopy

Proton magnetic resonance spectroscopy (1H-MRS) is an effective and useful technique for the metabolic analysis of tissues in vivo because it noninvasively identifies and quantities tissue metabolites such as N-acetylaspartate, lactate, and choline. This technique is frequently used to assess the chemical composition of normal and pathologic brain tissue to investigate infarction, neoplasia, and mitochondrial disease. Similar application of 1H-MRS to ocular disease may prove beneficial for the noninvasive analysis of intraocular metabolism. Tissues of particular metabolic interest, such as the optic nerve and retina, are not amenable to direct study with 1H-MRS because of volume constraints and the high likelihood of contamination of the spectra by surrounding tissues. However, the relatively large size of the vitreous body should allow spectroscopic assessment of ocular metabolism. Lactate was the dominant metabolite detected in a study using 1H-MRS with a high-field (4.7-T) magnetic resonance imaging (MRI) scanner to determine the vitreous metabolic spectrum in healthy rabbits. The goal of our study was to assess the feasibility of performing 1H-MRS on the human vitreous in vivo and to determine if lactate is the dominant spectral resonance.

Report of Cases. Four healthy subjects and 1 with optic neuropathy (5 eyes) participated in the study with institutional review board approval. We used 1H-MRS (1.5-T Phillips NT clinical scanner; Phillips Medical System, Best, Holland) with a standard head coil to view the spectra of the vitreous. A set of high-resolution T1- and T2-weighted images from different orthogonal orientations were recorded to provide anatomical landmarks. To minimize spectrum contamination caused by partial volume effect from surrounding tissues, a single 10 × 10 × 10-mm3 voxel was localized in the vitreous, using sagittal T1- and axial T2-weighted MR images (Figure 1). The spectra were acquired with single-voxel 1H-MRS using the point-resolved spectroscopy method with the following acquisition parameters: repetition time, 1500 milliseconds; echo time, 272 milliseconds; and sweep width, 1000 Hz. A 3-Hz line broadening was applied using a Gaussian filter before Fourier transformation. After Fourier transformation, the spectra were phase corrected. No baseline correction was applied. The water line width was in the range of 12 to 15 Hz after the automatic first-order shimming (3-5 minutes). The average number of signals was typically 800. During acquisition, a foam pillow was placed around the head to minimize head movement, and the subject was instructed to look at a fixation target to minimize eye movement. Using the chemical shift selective suppression method, 90% water suppression was accomplished. No additional fat suppression was performed. The spectra were processed and analyzed using the scanner manufacturer’s software. Lactate resonance was assigned by using the chemical shift of water as a reference and measuring the J-couple. Assignment of the lactate resonance was further confirmed by comparison with the spectrum of a phantom containing lactate solution.

Vitreous spectra collected in each of the 5 vitreous bodies using 1H-MRS yielded 1 dominant resonance in addition to a residual water signal (Figure 2). The chemical shift of this resonance was 1.38 ppm, which was determined using the resonance of water at 4.68 ppm as an internal reference. This resonance was a doublet with a J-coupling of 9 Hz compared with the theoretical J-coupling constant of 7 Hz for the methyl proton of lactate. The chemical shift and characteristic J-coupling supported the assignment of the resonance to lactate. The spectrum obtained from the patient with optic neuropathy did not vary from the spectra of healthy subjects.
Comment. Lactate is present in the human vitreous at a higher concentration than in other tissues, likely reflecting substantial normal retinal aerobic and anaerobic glucose metabolism. The proximity of the vitreous to the optic nerve and retina allows for diffusion of lactate into the vitreous. Elevated lactate concentration in the optic nerve and/or retina is generally reflected in the vitreous. Vascular insults, such as central retinal artery or vein occlusion, anterior ischemic optic neuropathy, ocular ischemic syndrome, or impairment of the mitochondrial respiratory chain found in mitochondrial diseases, may cause decreased oxygenation and elevated lactate production. The correlation of lactate production with the adequacy of perfusion and oxygenation of the retina and optic nerve suggests that it may be possible to use lactate as a molecular marker to evaluate retinal and optic nerve metabolism in ocular disease and monitor pathologic changes in the human vitreous. Elevated levels of brain lactate have been detected using $^{1}$H-MRS in patients with stroke, myoclonic epilepsy with ragged red fibers, or mitochondrial encephalopathy with lactic acidosis and strokelike episodes.

Our observation of lactate as the dominant resonance in the vitreous spectra in 5 human eyes in vivo suggests that characterization of the localized human vitreous spectrum in vivo is feasible using $^{1}$H-MRS. Similar detection of lactate in the human vitreous body was reported with the application of $^{1}$H-MRS in patients with glaucoma. Technical obstacles encountered in $^{1}$H-MRS application to the human vitreous include low sensitivity in detecting metabolites with a concentration lower than 10 mmol/L using a 1.5-T MRI scanner, and interference from the water signal (approximately 55 mmol/L), which requires efficient water suppression. Nevertheless, the in vitro vitreous lactate concentration of 7.8 mmol/L (calculated from a vitreous lactate concentration of 70 mg/dL using a conversion factor of 0.1110) suggests that it is possible to detect lactate in healthy eyes. Additionally, the application of a high-field 3-T MRI scanner should improve the sensitivity of $^{1}$H-MRS in studying the vitreous lactate because the signal intensity increases proportionally as the field strength increases.

Absolute quantification of the vitreous lactate concentration with $^{1}$H-MRS is necessary for maximum clinical applicability. Quantification should be possible through the use of an internal reference such as the unsuppressed water signal acquired from the same volume of interest as the metabolite to be quantified.

Using $^{1}$H-MRS to determine the normal human vitreous spectra and lactate concentration is the initial step in applying this technology to human ocular disease. Application of $^{1}$H-MRS to the human vitreous in vivo may provide a noninvasive method of evaluating and following retinal and optic nerve metabolism in healthy eyes as well as those with ocular disease.

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This study was supported in part by a departmental grant (Department of Ophthalmology, Emory Eye Center) from Research to Prevent Blindness,
Infections of the lacrimal gland are uncommon and can be divided into 2 major classes: acute suppurrative dacryoadenitis and chronic dacryoadenitis. Acute suppurrative dacryoadenitis is usually bacterial in origin, commonly caused by *Staphylococcus*, with *Streptococcus, Chlamydia trachomatis*, and *Neisseria gonorrhoeae* as other possible causes. Chronic dacryoadenitis is more slowly progressive and often caused by viruses, particularly the mumps virus. Other reported causes of dacryoadenitis include Epstein-Barr virus, pneumococci, diphtheria, syphilis, actinomycosis, histoplasmosis, trachoma, tuberculosis, typhoid, brucellosis, mononucleosis, measles, cytomegalovirus, coxsackievirus, echoviruses, and varicella-zoster virus. We describe an unusual case of an immunocompromised patient with dacryoadenitis caused by the herpes simplex virus (HSV).

Report of a Case. A 29-year-old man developed acute right upper eyelid tenderness, ptosis, and edema associated with an enlarged and indurated lacrimal gland. Marked conjunctival chemosis was present and ocular motility was mildly limited (Figure 1). The right preauricular node was both tender and palpable. The patient’s history was significant for acquired immunodeficiency syndrome, intolerant to highly active antiretroviral therapy. He was not taking antiretroviral therapy at the time of examination. He had previously been treated for syphilis and herpes zoster localized to the back and left lower extremity. His temperature was 37.5°C. Visual acuity was 20/40 OD and 20/20 OS. Ophthalmoscopy showed cotton-wool spots and dot-blot hemorrhages consistent with mild, bilateral retinopathy caused by human immunodeficiency virus. Orbital computed tomographic scan was notable for bilaterally enlarged lacrimal glands and diffuse right preseptal soft-tissue swelling (Figure 2).

Routine bacterial and fungal blood cultures were negative, as were routine bacterial and fungal conjunctival cultures. Because of allergies to penicillin and sulfa drugs, the patient was started on a regimen of clindamycin and ciprofloxacin hydrochloride. During the next 10 days, his condition worsened and the right orbital inflammation increased. A diagnostic right lacrimal gland biopsy was performed.

At surgery, the gland appeared indurated, without evidence of abscess. Cultures were obtained. Aerobic, anaerobic, acid-fast bacterial, and fungal cultures were negative. Interestingly, the conventional tube culture, derived from grinding the tis-