GLAUCOMA IN THE RETINA PRACTICE: PART 1


Surgeons seeing patients on a monthly basis have the added responsibility of diagnosing and managing open-angle glaucoma.

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As the treatments for retinal diseases have evolved since the advent of intravitreal injections, and anti-VEGF agents in particular, retina specialists often see patients on a monthly basis. Because of this, we are in the unique but challenging position of also detecting and managing glaucoma in these patients.

This review focuses on managing primary open-angle glaucoma (POAG) in the retina practice. Although neovascular glaucoma has many established associations with retinal vascular disorders, such as proliferative diabetic retinopathy (PDR) and central retinal vein occlusion, coordination is necessary between the retina and glaucoma specialist for surgical management. The topic of glaucoma secondary to vitreoretinal surgery will be reviewed in Part 2 of this series.

EPIDEMIOLOGY

Several diseases encountered in the retina practice, such as diabetes and myopia, are known risk factors for POAG.[1,2] Additionally, patients with macular degeneration can develop glaucoma.[3] Griffith and Goldberg reported that 14.8% of patients in their glaucoma clinic had comorbid retinal disease, with unspecified cystoid macular edema (CME), macular degeneration, PDR, and branch and central retinal vein occlusions being the most common.[4]

DIAGNOSIS AND MONITORING

Diagnosis and monitoring of POAG involves a multifaceted approach with clinical examination and adjuvant testing, such as automated perimetry and OCT. Although many patients with glaucoma also have concurrent retinal pathology, questions remain regarding the reliability of available testing strategies for adequate diagnosis and monitoring.

IOP Measurements

The first clinical sign that indicates glaucomatous damage is IOP. Although Goldmann applanation tonometry (GAT) is the standard measurement tool,[1,5] we use the Tono-pen (Reichert) in our practice. This device has several advantages over GAT, including simplicity of use, portability, absence of fluorescein-related flare, the ability to measure over soft contact lenses, and the fact that measurements are not dependent on patient positioning for those with irregular corneas and irregular tear films.[5]

Handheld rebound tonometers can be used to measure IOP at the peripheral cornea and do not require topical anesthetics.[5] Keep in mind that, in subjects without confounding corneal disease, both rebound tonometry and Tono-pen overestimate IOP compared with GAT.[6,7] Rebound tonometry is affected more by central corneal thickness (CCT) than Tono-pen or GAT.[6] Based on manometric data, the Tono-pen is more accurate than GAT in edematous, irregular corneas and in patients post-penetrating keratoplasty.[8,9]

Optic Nerve Assessment

Clinical assessment of the cup-to-disc ratio is routinely done at the slit lamp. However, prior to clinical examination with biomicroscopy, many retina specialists have access to digital infrared images of the optic nerve head through spectral-domain OCT (SD-OCT). The appearance of the optic nerve in infrared images allows estimation of the cup-to-disc ratio.[10] Further, SD-OCT provides superior anatomic correlation of the optic disc margin to detect remaining neuroretinal rim tissue; clinical examination often overestimates the amount of remaining neuroretinal rim.[11]

OCT is a useful and reliable tool for detecting changes within individual layers of the macula and the peripapillary optic nerve.[12,13] However, decentration of the retinal nerve fiber layer (RNFL) circle scan can lead to significant alterations in RNFL thickness measurements.[14] With continued advances in OCT, interest has grown in the role of macular ganglion cell-inner plexiform layer (GC-IPL) thickness in glaucoma. Macular GC-IPL thickness analysis can detect glau-

comatous changes and is comparable to RNFL.[15] In advanced glaucoma, GC-IPL progression analysis can detect glaucomatous changes better than RNFL progression analysis.[16] However, with macular edema and atrophy, there is lower repeatability in GC-IPL measures, decreasing this metric's accuracy for identifying glaucomatous damage.[17] Thinning of both RNFL and ganglion cell layers are present in neovascular AMD, whereas there is thinning of ganglion cell layers but preservation of RNFL in patients with geographic atrophy.[18]

In patients with diabetic retinopathy requiring panretinal photocoagulation (PRP), there is initial thickening after PRP, followed by progressive, significant thinning of RNFL measurements 2 years after treatment.[19]

Cataracts and other media opacities worsen the repeatability and accuracy of RNFL OCT measurements.[12,20] Further, RNFL thickness appears to increase after cataract surgery secondary to the preoperative underestimation of RNFL thickness related to signal strength errors.[20]

Although RNFL and GC-IPL measurements are affected by retinal pathology and their treatments, some new methods of assessing anatomic correlations of the optic nerve head with SD-OCT are being evaluated.[21] The Bruch membrane opening (BMO) represents a good anatomic landmark that is consistently identifiable with SD-OCT.[11] The assessment of the BMO-fovea axis creates a reproducible anatomy-based reference for more accurate analysis of the RNFL.[13]

Several additional parameters are being assessed using BMO as the anatomic landmark. The BMO-minimum rim width (BMO-MRW) is an assessment of neuroretinal rim thickness, as measured from the BMO to the internal limiting membrane, that is comparable to RNFL in detection of glaucoma.[22] BMO-MRW loss occurs before perimetric vision loss.[23] The BMO-minimum rim area (BMO-MRA) is less dependent on optic disc size.[24] Although both BMO-MRA and BMO-MRW can detect early glaucomatous change, at present RNFL thickness measurements are more reliable in measuring glaucomatous progression.[25]

In myopic patients, GC-IPL is comparable to RNFL in the detection of glaucoma.[26] Further, BMO-MRW is less likely to falsely identify glaucomatous damage in myopic eyes.[27,28]

However, normative data for these structures in most retina pathology are unknown, as are the effects of treatments (eg, PRP) of the neuroretinal rim on these parameters.

Perimetry

Visual field changes and fixation impairment have been noted in patients with diabetic retinopathy and macular degeneration.[29,30] Further, the effect of PRP on visual field assessment has been well documented.[31] In a typical glaucoma population, fixation loss is the primary cause of unreliable visual field assessment.[32] Thus, visual field and automated perimetry testing for glaucoma diagnosis and monitoring have little clinical value in a retina practice.

Intravitreal and Periocular Injections

Periocular injection of steroids can lead to ocular hypertension, and intravitreal steroid formulations also carry a risk of elevating IOP; most of this can be managed medically.[33] However, surgical intervention is more frequent depending on the type of steroid implant.[34] IOP lowering can be achieved with removal of the corticosteroid.

The use of intravitreal dexamethasone as an adjunct to ranibizumab (Lucentis, Genentech) results in an increased incidence of ocular hypertension without improving visual acuity.[35] However, patients who are switched to intravitreal dexamethasone after early recognition of a poor anti-VEGF response have improved visual acuity and anatomic outcomes.[36]

Because glucocorticoids can increase outflow resistance, IOP elevations after the administration of intraocular or periocular steroids should, theoretically, be inconsequential in the presence of a filtering procedure.[37]

Intravitreal injection causes an immediate IOP rise after injection.[38] The elevation is variable depending on the amount of drug injected and needle gauge, with smaller diameter needles leading to higher postinjection IOP.[39]

There is a decrease in peripapillary RNFL thickness after monthly intravitreal injections.[40] Anterior chamber paracentesis at the time of intravitreal injection prevents the immediate postinjection rise in IOP and associated RNFL loss.[40] Prophylactic IOP-lowering medications are ineffective at preventing postinjection IOP increases.[41]

Intravitreal injections of anti-VEGF agents can cause acute and chronic changes to BMO, optic nerve cup deepening, and RNFL thickness when measured by SD-OCT, particularly in the inferior optic nerve head.[42]

Recently, a bimatoprost intracameral implant (Durysta, Allergan) has become available for the treatment of POAG. The implant, injected with a 28-gauge applicator into the anterior chamber, has been shown to be noninferior to topical timolol administration.[43]

CME Secondary to Prostaglandin Analogues

Prostaglandin analogues such as latanoprost are widely used to treat ocular hypertension and glaucoma. Despite their relatively safe profile, there is a small risk of the development of CME. The incidence is around 1% overall, but patients who develop CME are those who have confounding ocular conditions including prior ocular surgery, uveitis, absence of posterior capsule, pseudophakia, aphakia, or retinal inflammatory or vascular conditions such as diabetic retinopathy.[44]

In addition to prostaglandin analogues, timolol and the preservative benzalkonium chloride can worsen CME following cataract extraction.[45] Resolution of prostaglandin-associated CME is achieved by discontinuation of the medication, use of a topical nonsteroidal antiinflammatory drug (NSAID), or both.[45] The concurrent use of a topical NSAID does not affect the ocular hypotensive effects of either timolol or latanoprost.[45]

GIVEN THE LOW INCIDENCE OF PROSTAGLANDIN-ASSOCIATED CME, PROSTAGLANDIN ANALOGUES MAY BE USED SAFELY IN THE PRESENCE OF CONCURRENT MACULAR PATHOLOGY.

CONCLUSION

Technologic advancements allow the potential early detection and monitoring of glaucomatous progression, which can prevent additional peripheral visual field loss. However, a variety of comorbid retinal conditions limit the reliability of conventional testing modalities. In addition, there are limited data regarding the effect intravitreal injections have on the optic nerve head. Thus, further longitudinal studies are needed.

Anterior chamber paracentesis at the time of intravitreal injection may be necessary for an at-risk population to prevent further glaucomatous optic neuropathy. A comprehensive clinical approach assessing IOP trends and optic nerve head status at each visit may help detect early glaucomatous damage.

Advances in OCT measurement algorithms and technologies will continue to be an asset for the detection and monitoring of glaucoma in the retina practice. Given the low incidence of prostaglandin-associated CME, prostaglandin analogues may be used safely in the presence of concurrent macular pathology. Retina physicians should be prepared to assist in the medical management of glaucoma with the continued development of repository medications for lowering IOP. ■

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