Optic nerve compression by the Internal Carotid Artery
in a patient with Normal Tension Glaucoma

ABSTRACT:
A patient develops glaucomatous optic nerve cupping and visual field defects with radiological
evidence of optic nerve compression by the supraclinoid segment of the internal carotid artery. This
may contribute to the development of normal tension glaucoma.

CASE REPORT:
An 82 year old Caucasian male presents to the clinic for a routine annual eye exam with no
visual complaints. His last dilated examination one year earlier was unremarkable except for mild
cataracts in both eyes, inferior retinoschisis of the left eye and soft macular drusen in both eyes. His
systemic history is significant for hypertension, hyperlipidemia, anemia and previous chemotherapy for
abdominal cancer. His medication list includes simvastatin, oxybutynin chloride, atenolol, and
finasteride.

Upon dilated exam, optic nerve assessment reveals small cupping with healthy rim tissue in the
right eye. The left eye shows a distinct focal notch inferotemporally with advanced cupping
approaching the rim in that region. Intraocular pressures (IOP) at that visit are 19 and 21 (right and left)
with average central corneal thickness as measured by pachymetry. A baseline glaucoma workup was
performed 2 months later including a Humphrey threshold 30-2 visual field. The right eye was unable to
be interpreted at that visit secondary to poor reliability of the test. Visual field results of the left eye
show a dense superior arcuate defect with the temporal portion exhibiting vertical respect of the midline.
Given the atypical presentation, additional etiologies are suspected and a subsequent Magnetic
Resonance Imaging (MRI) of the brain and orbit is ordered to rule out other pathology. The patient is
started on treatment with Travatan ophthalmic drops in his left eye to initiate reduction of his intraocular
pressure despite questionable benefit it may have on his optic nerve deterioration. The MRI was
performed and results showed the supraclinoid segment of the left internal carotid artery (ICA) to be in
contact with and flatten the inferior aspect of the left optic nerve. There was contact but no significant
compression of the right optic nerve and no other intracranial or intraorbital abnormalities noted.

Compression of the optic nerve by the internal carotid arteries has been a suggested etiology of
visual field defects in those with optic neuropathy as well as normal tension glaucoma (1-5). The exact
mechanism by which these vessels cause damage to the optic nerve is poorly understood and is thought
to be either the result of direct compression of the nerve fibers or ischemia secondary to occlusion of
small vessels that supply these structures. Few reports have even shown surgical decompression to
improve visual field outcomes if performed early in the clinical course (3,5).

Compressive lesions of the optic nerve are usually due to aneurysms, meningiomas or other
tumors and often result in optic nerve head pallor. However, several reports have shown compressive
lesions to cause glaucomatous-like cupping which may complicate prompt and accurate diagnosis
(6,7,8).

In our patient, a considerable reduction in IOP is achieved with the Travatan, however
subsequent visual field testing provides evidence of worsening progression of optic nerve damage
despite the lowered IOP. On follow up examinations, the patient begins to develop cupping of the right
optic disc with repeatable glaucomatous defects on visual field testing. Travatan is started in the right
eye and an additional ocular hypotensive drug, Alphagan, is prescribed to be used twice a day in each
eye. Although there is radiological evidence of direct compression of the left optic nerve by the internal
carotid artery, this patient appears to be developing a clinical course consistent with Normal Tension
Glaucoma. With the lack of research and understanding involving ICA compression on optic neuropathy, this patient is currently followed as a glaucoma patient and appropriately receiving treatment as such.

Normal tension glaucoma (NTG) is the term used to describe optic neuropathy and visual field defects in the setting of normal intraocular pressure. Various mechanisms have been associated with increased vulnerability of the optic nerve to normal IOP which include vascular insufficiency, decreased intracranial pressure and other factors that decrease optic disc resistance (9-12). Neuroimaging studies have been recommended in the diagnostic evaluation of patients suspected of having normal tension glaucoma to rule out other pathologies, however not routinely administered unless atypical presentation is observed. The relationship between NTG and compression by the internal carotid artery was evaluated by Ogata, et al in 2005. MRI results comparing NTG patients and age matched controls showed a significantly higher percentage of NTG to have optic nerve compression by the ICA (13). These findings support the hypothesis that optic nerve compression by the ICA may be a cause or at least a risk factor for the development of NTG.

In conclusion, we report a case of optic nerve cupping and visual field loss in a patient found to have compression of his optic nerve by a normal internal carotid artery. This appears to be a rare finding and more research is needed to fully understand the relationship this compression has on the development and prognosis of normal tension glaucoma. It behooves those who treat and manage patients with ocular disease to be aware of this condition and consider additional pathological etiologies in patients who develop atypical optic neuropathy and visual field defects, especially when present with normal intraocular pressure.
References