

Etiology and Management of Diplopia

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Diplopia is a common visual complaint in the elderly. A wide variety of causes is possible, ranging from benign conditions with spontaneous resolution to serious life-threatening conditions. A proper history that details the characteristics of the diplopia is essential in determining its cause, prognosis and management.

Key words: diplopia, double vision, comitancy, convergence insufficiency, ocular motor palsy.

Definition and Differential Diagnosis

Diplopia, as defined in *Dorland's Illustrated Medical Dictionary*, is “the perception of two images of a single object”.¹ In fact, the word diplopia is derived from the Greek words diplous and ops, meaning “double” and “eye”, respectively. For the purposes of this article, the terms diplopia and double vision will be used interchangeably.

Often, we ask patients if they have double vision and it is all too common for us to receive a positive response. However, a patient’s perception of diplopia is often not the same as the condition’s definition. It is therefore important to ask patients what they mean by double vision and to have them describe what they actually see. Responses may include decreased or loss of vision, hemianopia or other visual field defects, as well as after images, image distortion or aching eyes, all of which can be misconstrued as diplopia.

It is also important to rule out both monocular and physiologic diplopia. Monocular diplopia persists in the affected eye despite covering the other eye. Monocular diplopia rarely represents serious pathology, its most common causes being uncorrected refractive error (usually astigmatism) and cataract. Other causes of monocular diplopia are corneal surface irregularities (scarring or dryness), keratoconus or, rarely, vitreous opacities and retinal conditions. A quick and easy method for evaluating monocular diplopia is to have the patient look through a pinhole with the affected eye while the other eye is occluded. If the monocular diplopia resolves during this test, then one can be

fairly comfortable in attributing the problem to an optical cause, which can be treated with glasses, contact lenses, artificial tears (for dry eyes) or cataract surgery.

Physiologic diplopia is noted when an individual is focusing on a target, but the objects both in front and behind the point of focus appear as double. Although its presentation is more common in children, physiologic diplopia may not be discovered until later in life. This is a normal phenomenon that simply requires the physician to reassure the patient that there is no serious underlying neurological disorder.

Binocular diplopia, however, indicates a breakdown of the fusional capacity of the binocular system, making its verification particularly important. When confronted with a patient complaining of binocular diplopia, further information is required to try to determine a cause (Table 1).² Comitancy ocular deviations are the same in all gaze positions, whereas incomitancy deviations vary with different gaze positions. Patients who have comitancy deviations usually do not complain of diplopia

because of the cortical ability to suppress one image (suppression scotoma). This suppression is associated with congenital strabismus which, on occasion, can “break down” or change, causing diplopia. Comitancy deviations are frequently referred to as decompensated deviations or phorias.³

Patients who have incomitancy deviations usually complain of diplopia and the most common causes are acquired. The deviations are typically due to restriction or weakness of one or more of the extraocular muscles. A variety of etiologies is possible, but the more common conditions that affect the elderly and result in double vision are discussed here in detail.

Convergence Insufficiency

This is a fairly common cause of horizontal diplopia that manifests with prolonged near vision tasks (reading, writing, computing). Convergence insufficiency is more common in patients who have Parkinson’s disease. Patients will complain of sore or tired eyes and letters or words that “run together” or appear double. The diplopia is relieved after a brief period of rest, but symptoms will return. The etiology may be an uncorrected refractive error, but usually it arises without any obvious cause. It may be confused or exacerbated by dry eyes, since the normal blink rate is reduced with near vision tasks. In addition, many antidepressants, through their anticholinergic properties on accommodation, can exacerbate symptoms of convergence insufficiency. Treat-

Table 1

Pertinent Questions to Establish Cause of Binocular Diplopia

Is it horizontal, vertical, oblique or torsional diplopia?
Is it worse (or better) with changes in gaze or head position (comitancy)?
Is it worse for distance or near viewing?
Is there any variability or fatigability?
Is the onset acute or gradual?
Are there any associations, particularly a history of strabismus or amblyopia, loss of vision, ptosis, pain or systemic health problems (e.g., diabetes or hypertension)?

Diplopia

ment is aimed at improving convergence with exercises, but prisms or even strabismus surgery are sometimes indicated.

Ischemic Ocular Motor Palsies

These are very common causes of diplopia in the elderly; fortunately, the majority resolve spontaneously within one to four months. The presumed etiology in these cases is microvascular ischemia to one of the ocular motor nerves (third, fourth or sixth cranial nerves). The microvascular disease is usually seen in association with diabetes, hypertension and atherosclerosis. These patients often present with a sudden onset of diplopia, and the ocular motility examination confirms underaction of the appropriate muscle. Orbital pain is sometimes present at the onset but will resolve within a few days. The abducens (sixth) nerve is the most common nerve to be affected, followed by trochlear and third nerve palsies. If the examination is consistent with an isolated cranial nerve palsy, then no further investigations are usually required, with the following exceptions:

- nonresolving palsy (> four months);
- worsening palsy after one month;
- associated neurological signs or symptoms;
- dilated pupil (in the case of third nerve palsy);
- papilledema and;
- variable ptosis and diplopia (myasthenia?).

Other Neurological Conditions that Cause Diplopia

Stroke

This is a common cause of diplopia in the elderly, especially if the infarcted area involves the brainstem or cerebellum. A specific cranial nerve may be involved, but often the stroke causes multiple cranial nerve palsies or it may even result in supranuclear (skew deviation) ophthalmoplegia. Oscillopsia (oscillating vision) caused by nystagmus or homonymous visual field defects also may be present.

Myasthenia

This condition may present in the elderly population with a history of variable

and/or fatigable diplopia, sometimes associated with ptosis. The symptoms tend to worsen as the day progresses but often improve after a brief rest. The pupil examination is normal, and pain and other sensory symptoms are typically absent in this neuromuscular junction disease that is autoimmune in nature. Myasthenia may mimic any ocular motor muscle palsy, including specific brainstem findings such as internuclear ophthalmoplegia (INO). It is important to inquire about systemic symptoms of myasthenia which can sometimes be life threatening, such as dysarthria, dyspnea, dysphagia and proximal muscle weakness. The Tensilon™ (edrophonium chloride) test remains the standard for the diagnosis of this condition, and treatment with pyridostigmine and/or immunosuppressives is often required.

Parkinson's Disease

Due to the supranuclear effects on eye movements, patients with Parkinson's disease will often have difficulty with vertical eye movements, requiring a separate pair of reading glasses rather than bifocals. Furthermore, as previously mentioned, convergence insufficiency is common in these patients. Anticholinergics, reduced vertical eye movements and decreased blinking all contribute to a worsening of symptoms, sometimes making convergence insufficiency very resistant to treatment in this group of patients.

Intracranial Tumours

Diplopia due to brain tumours may be noted if the location of the tumour involves or is in close proximity to the ocular motor nerves (i.e., brainstem or cerebellum). If there are multiple cranial nerve palsies, one must consider a mitotic lesion in the brainstem, cavernous sinus or orbit, or leptomeningeal seeding of a tumour. If an intracranial tumour is suspected in an elderly individual presenting with diplopia, neuroimaging studies and sometimes spinal fluid analysis are required.

Restrictive Causes

Although unusual, elderly patients may present with diplopia due to thyroid-

associated ophthalmopathy. The external and eyelid features—eyelid retraction or stare appearance, exophthalmos, orbital edema—are usually present before the onset of diplopia. Vertical diplopia is the most common complaint since the most frequent muscle to be involved is the inferior rectus, although all extraocular muscles are affected to varying degrees. In the absence of typical external findings, one may require ocular forced duction testing, orbital CT imaging with axial and coronal views, and thyroid function testing to aid in the diagnosis.

Optical Causes

Bifocals are an often overlooked cause of diplopia. Improper manufacturing (grinding) of lenses, misalignment of optical centres, or bent and twisted eyeglass frames are the most common problems. Anisometropia (significantly different refractive error between the two eyes) created after just one cataract has been removed is a very common cause of “post-operative, iatrogenic diplopia”, but symptoms usually resolve after the second cataract has been removed.

Post-traumatic Diplopia

Even with minor head injuries, one may develop either restrictive or paretic causes of diplopia. Orbital fractures may cause the extraocular muscles to become entrapped within the bony orbital defect. Extraocular muscle palsies, either infranuclear or supranuclear, also may be due to head injuries. It is important to obtain appropriate neuroimaging studies, including orbital views, to determine a cause.

Post-operative Diplopia

The history will indicate the onset of diplopia after a surgical procedure, such as cataract, strabismus or retinal detachment surgery. The causes may range from damage to extraocular muscles or nerves (binocular diplopia) to dislocated intraocular lens (monocular diplopia).

Medications

There are several medications that include diplopia as a “listed” side effect. Medication-induced diplopia is usually due to an

Table 2

Suggested Treatments for Diplopia

Condition	Management
Convergence Insufficiency	Eye exercises Prisms Strabismus surgery (rarely) Treat associated dry eyes
Ischemic Ocular Motor Palsies	Spontaneous resolution Prisms (temporary) Strabismus surgery (nonresolving)
Other Neurologic Conditions	
Stroke	Spontaneous resolution Prisms Strabismus surgery (rarely)
Myasthenia	Pyridostigmine Immunosuppressives Head turn Prisms (rarely) Strabismus surgery (rarely)
Parkinson's Disease	Separate reading glasses Treat convergence insufficiency Treat associated dry eyes
Intracranial Tumour	Neurosurgical intervention Prisms Strabismus surgery
Restrictive Causes (Thyroid)	Prisms Head turn Strabismus surgery (if stable)
Optical Causes	Bifocal (eyeglass) adjustment Cataract surgery
Post-traumatic Diplopia	
Head Injury	Spontaneous resolution Prisms Strabismus surgery (if stable)
Orbital Fracture	Orbital fracture repair Prisms Strabismus surgery
Post-operative Diplopia	
Dislocated Intraocular Lens	Lens repositioning
Retinal Detachment Surgery	Strabismus surgery Prisms
Medications	Discontinue offending agent

unwanted side effect, such as reduced accommodation with anticholinergics. If a medication is thought to be the cause of the diplopia, discontinuing the drug, if possible, followed by a re-challenge to see if symptoms recur is warranted.

Management

The management of diplopia is individualised according to its specific cause. Each etiology has its own natural history and associated morbidity.⁴ Diplopia itself has significant morbidity in terms of confusion with orientation and loss of depth perception. The goal is to try to restore binocular vision if possible. This can be done by various means, such as eye exercises, medications, proper alignment of optical centres in glasses, paste-on Fresnel[®] or ground-in prism on glasses, the use of appropriate head posture or strabismus surgery (Table 2). Often, a combination of treatments is used. If such measures are unsuccessful, patients may be advised to occlude the poorer seeing eye, preferably with translucent tape on their glasses. As is the case with most ischemic ocular motor palsies, the translucent monocular occlusion is only required temporarily, until the diplopia spontaneously resolves.

In summary, diplopia is a reasonably common visual complaint of the elderly. Although there are numerous causes, one may be able to pinpoint a specific etiology after establishing important historical information. ◆

No competing financial interests declared.

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