Article ▸

Prevalence of Vision Disorders After Stroke: A Pilot Study to Identify the Visual Needs of Stroke Patients

Marsha Davis Benshir, OD, New Market, Maryland

ABSTRACT

Background: Post-stroke vision disorders can significantly affect recovery and quality of life for many patients, affecting mobility, perception, communication, and independent function. As improvements in medical intervention increase life expectancy, the need to identify factors that will inhibit recovery and to address those needs through medical and rehabilitative treatment becomes more significant.

Methods: A survey of 200 stroke patients at an acute in-patient rehabilitation hospital demonstrated the prevalence of vision disorders in this population. These patients are believed to be a representative sample of stroke patients requiring long-term rehabilitative care. Patients with catastrophic brain damage, immediate or uncomplicated recovery, or death are not represented in this sample. Vision evaluations were performed on patients, and results were reported to the physiatrists and rehabilitation therapists, with the goal of enhancing the efficacy of therapeutic intervention.

Results: When tabulated, these results demonstrated a high prevalence of vision disorders secondary to stroke, including binocular vision disorders, strabismus, ocular motor disorders, visual field loss, and extra-ocular muscle paralysis. Refractive correction was not included as a vision disorder due to the ease and accessibility of prescription lenses. Over 95% of the patients in this study were found to have vision disorders that could potentially impact their recovery.

Conclusion: These findings suggest that all stroke patients should have an appropriate vision evaluation to detect and to correct post-stroke vision disorders.

Keywords: binocular vision disorder, ocular motor disorder, rehabilitation, stroke, vision, visual field loss

Introduction

With increased general awareness of the symptoms of stroke and advances in medical care, stroke patients are more likely to have an early diagnosis, and more patients are surviving. According to the National Institutes of Neurological Diseases and Stroke, more than 700,000 people in the U.S. suffer a stroke every year.[1] Of these patients, approximately 10% will not survive, 10% will have negligible permanent damage, and approximately two-thirds will survive and require rehabilitation. After an initial hospitalization period, these patients will spend between two and three weeks in an acute in-patient rehabilitation facility before being discharged to home, to a skilled nursing facility, or to another supportive care environment.

An in-patient rehabilitation service generally evaluates and prescribes rehabilitation in the areas of physical therapy, speech and language, and occupational therapy.[2] The functional status of the visual system can play a central role in the effectiveness of such therapy plans. All of these rehabilitation approaches will be affected by visual acuity, depth perception, and peripheral vision, as these skills are required for a good rehabilitative outcome; however, few rehabilitation programs specifically address vision problems in a stroke population.[3] It is estimated that over 70% of stroke patients will have an eye movement disorder that can impact their rehabilitation outcome and their return to independent living.[4] This implies that the diagnosis and treatment of vision disorders may be a critical component in overall return to independent activities of daily living (ADLs) for many stroke patients.

This study is an accumulation of data on 200 post-stroke patients evaluated at an acute in-patient rehabilitation facility. The majority of patients did have vision disorders that could impede their progress with other rehabilitative therapies and potentially limit their ability to regain independent function.

Methods

Patient selection was from a 54-bed acute in-patient facility with out-patient programs. The patient population is limited to adults and encompasses multiple diagnoses and needs. At any given time, approximately 25% of the patient population suffers from sequelae of stroke. Additional neurological, medical, and orthopedic diagnoses make up the rest of the patient population.

A neuro-optometrist specializing in the diagnosis and treatment of vision disorders secondary to neurological syndromes evaluated all assigned patients. Ocular pathology was referred to a consulting ophthalmologist. The goal was to identify those patients with significant vision disorders, to provide diagnostic information to the physicians and therapists working with those patients, and to initiate basic vision rehabilitation. The consulting neuro-optometrist was scheduled to see patients weekly and to provide therapeutic instructions to the rehabilitation therapy staff.

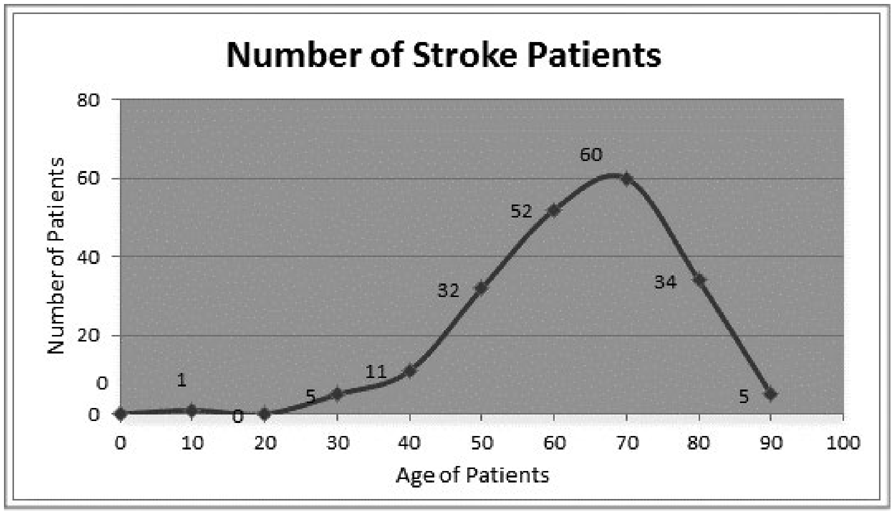

Figure 1. *Age distribution of patients*

All patients with acquired brain disorders were to be referred for a neuro-optometric evaluation by the attending physiatrists. Patient diagnoses included stroke, post-craniotomy, TBI, and neurodegenerative disorders. Additional referrals were made based upon patient complaints, observations of medical and therapeutic staff, and concerns expressed by family members. Patient records were pulled alphabetically and were limited to those stroke patients examined over the first 3 years. Data from those records was compiled; 200 total records were used. Of those records, 112 patients were male (56%), 88 female (44%), and the average age was 68 (Figure 1). This is comparable with the expected population for a stroke diagnosis.[5]

A significant body of information was collected on these patient records and used to compile a database. The selectivity of this population presents a higher prevalence of vision disorders than other studies; however, the breadth and specificity of the vision examination was greater than the vision screenings generally used.[6] The types of vision disorders diagnosed were found to be consistent with a few similar compilations; however, a search of the literature revealed relatively little information about the prevalence and impact of post-stroke vision disorders.[7-9] The types of stroke were not specified in these data and are not specified in other large studies.

Patient data was tabulated in an Excel spreadsheet using coded patient identification, age, gender, and absence or presence of specific types of vision disorders. The vision disorders were categorized as general binocular vision disorder, ocular motor disorder, strabismus, extra-ocular muscle paralysis or palsy, and visual field loss. Many patients had more than one type of vision disorder. In addition, patients without any of the specified vision disorders were identified.

Co-morbidity is considered significant, with an acknowledged relationship between stroke and glaucoma and ocular pathologies found in an older population with similar contributing factors.[10] The causative factors that overlap between stroke and ocular pathology are not identified in this database (i.e., diabetes, systemic hypertension, glaucoma, or secondary head trauma), indicating that these causes of vision disorders have not been factored out. A more in-depth patient history than was available is necessary for this degree of accuracy.

Vision Testing

Appropriate vision testing procedures were adapted to require minimal verbal response. Not all patients could complete the full testing protocol. Visual acuity was difficult to measure accurately for most patients due to absence of corrective lenses, aphasia, dementia, and other factors. For rehabilitation purposes, it was necessary for the staff to know whether the patient could focus with reasonable accuracy at near and far, and at what distances visual stimuli would be effective. This estimation was done with retinoscopy at far and near, eliminating the need for subjective responses. This measurement was not compiled due to the potential for inaccuracy of the data (poor attention, communication problems, medication, lethargy, etc.). Eye health screenings were performed on all patients, with referral for ophthalmological intervention as indicated. This was done by visual inspection of eyes and surrounding tissue, as well as use of an ophthalmoscope. Pupil reflexes were documented.

Optokinetic nystagmus was stimulated on all patients in 4 directions (laterally and vertically) using an optokinetic drum. This reflex is readily observed in patients with poor subjective responses. Physiological H and convergence were assessed with a penlight. This permitted corneal reflection to be used for observation and evaluation of fixation ability, pursuit movements, gross binocular alignment, and identification of extra-ocular muscle disorders. Cover testing was used to evaluate binocularity at near and far. In general, patients demonstrated better reflex fixation at near than at distance, with more accurate results. Red lens and Maddox rod testing were performed and neutralized using prism lenses when possible.

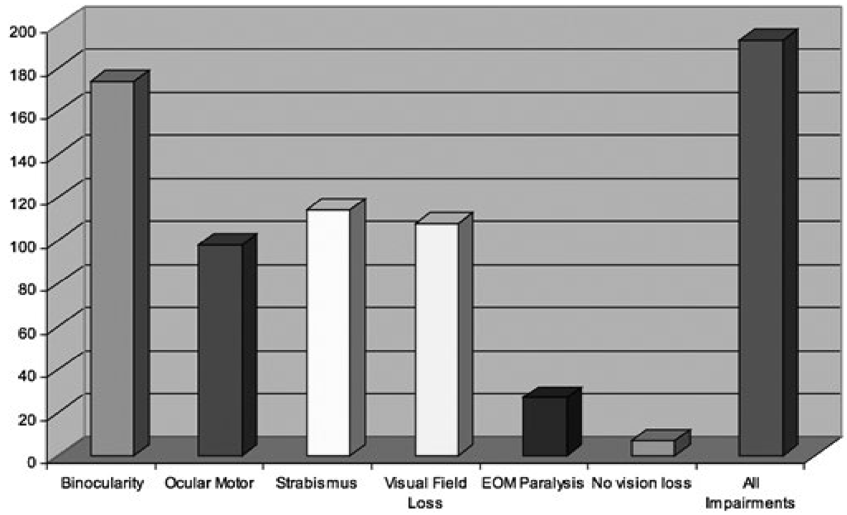

Figure 2. *Prevalence of vision disorders*

Visual fields were tested using a tangent screen. Most patients were able to understand the test and could maintain fixation with encouragement. Testing probed for false positive responses. Each eye was tested, and the results were recorded on a basic cross, locating the normal blind spot, any field constriction, large field loss, or obvious scotoma. Non-verbal patients were able to respond to testing with a one-syllable response or a raised finger. Only those patients with responses indicating a consistent visual field loss are reported here.

Patients with the ability to attend to detail and to respond verbally were shown a series of binocular tests using the Keystone Visual Skills test. Familiarity appeared to enhance responses to this battery of tests, but that data has not been included here. Many patients could not respond correctly due to aphasia, agnosia, or visual spatial neglect.

Patients were scheduled for a one-hour evaluation with the consulting neuro-optometrist. Each evaluation was followed up with a written report for the patient's record. Vision rehabilitation was prescribed as needed, with specific procedures recommended to the therapy staff. Follow-up exams were recommended. Test results were shared with custodial family members, and referrals for vision care after discharge were provided.

Results

One hundred and eight patients had visual field loss as measured with a tangent screen. Eight patients could not be tested. This represents 54% of total patients with visual field loss, 4% not testable. This incidence of visual field loss does not exclude non-stroke pathology and vision loss that may spontaneously resolve.[11] It should be noted that vision loss present during acute inpatient rehabilitation can impact therapeutic interventions and impede recovery even if there is subsequent improvement.[4]

Ninety-eight patients manifested ocular motor disorders, including poor fixation and inability to track a slowly moving target (49%). Patients with extra-ocular muscle palsy were also included in this group; however, they were separated out as a category in order to differentiate between mild and severe neuro-motor impairment. Binocular vision disorders found included strabismus, diplopia, suppression, and convergence insufficiency. There were a total of 174 patients with binocular vision disorders (87%). Strabismus was identified in 114 patients (57%). This included paralytic, periodic, and with and without diplopia. Significant paralysis of one or more extra-ocular muscles was identified in 27 patients (13.5%). The total number of vision disorders was greater than the total number of patients due to multiple diagnoses for many patients.

Seven patients did not have any significant vision disorders secondary to their stroke. This means that only 3.5% of this stroke population did not have a vision disorder that could impede rehabilitation treatment plans (Figure 2). In this population, 193 patients experienced significant functional vision disorders secondary to stroke (96.5%). Afferent pupillary defects were not included in this compilation. Many pupil defects observed post-stroke will be transient (improved cerebral vascular perfusion after treatment) or will be artifacts or pupil anomalies that are either caused by medication (opioid medications for pain) or are influenced by optical factors (uncorrected hyperopia).

Discussion

According to many rehabilitation professionals, visual performance skills are important in recovery from stroke. Poor visual skills increase the likelihood of falls and impair ambulation due to loss of depth perception and impaired visual spatial judgments.[12] Vision impairments affect reading, writing, and communication. They can interfere with self-care and many ADLs. Vision profoundly affects the ability to drive safely and can limit independent function.[9] There is strong evidence that stroke will affect visual motor function, even though it may not have a direct impact on visual acuity. This distinction is important for all rehabilitation professionals to understand. Impairment of the motor functions of vision

Table 1. Functional Scales for Stroke Patients

Barthel Index	NIH Stroke Scale	FIM
Feeding*	Level of consciousness**	Eating*
Bathing*	Best gaze*	Grooming*
Grooming*	Visual*	Bathing*
Dressing*	Facial palsy**	Upper body dressing*
Bowels	Motor arm**	Lower body dressing*
Bladder	Motor leg**	Toileting*
Toilet use*	Limb ataxia	Bladder management
Transfers*	Sensory**	Bowel management
Mobility*	Best language**	Bed to chair transfer*
Stairs*	Dysarthria	Toilet transfer*
	Extinction/inattention*	Shower transfer*
		Locomotion*
		Stairs*
		Cognitive comprehension**
		Expression**
		Social interaction**
		Problem solving*
		Memory*

*Visually guided **Impacted by/impacts vision

in younger patients will cause difficulty with accommodation and can cause blurry vision, although this is not the case with the majority of stroke patients who are beyond the onset of presbyopia.

There are many co-morbid factors between stroke and vision. Stroke patients will be more at risk for related ocular pathology (such as glaucoma, branch retinal vascular occlusion, and age-related macular degeneration) because some risk factors for stroke (e.g., smoking, diabetes, hyperlipidemia, systemic hypertension, clotting disorders) will also contribute to these ocular pathologies.[10] Patients who have experienced cerebral vascular hemorrhage may be at greater risk for retinal hemorrhage. This can cause a precipitous loss of sight that must be treated as a medical emergency. Stroke patients with catastrophic ocular disorders often have impairments that will interfere with cognition and communication so that they are unable to understand or to report their vision loss.[8,9,13]

Vision disorders in stroke patients can have an obvious impact on reading, writing, eye-hand coordination, and symbol recognition. Secondarily, these problems will interfere with using a phone or computer and can even frustrate a patient trying to tune a digital radio or watch TV. Patients with visual field loss will be more prone to accidents involving obstacles that they do not see. Diplopia caused by ocular motor or binocular disorders will affect performance on all visual tasks, including ambulation and assisted mobility. The traditional treatment of patching one eye may not be the treatment of choice, as it serves to limit peripheral vision on that side, causing further need for adaptive therapy. This can also inhibit neuroplasticity by limiting afferent feedback during the rehabilitation process.

There are several instruments used to evaluate overall function in stroke patients. According to the American Heart Association, the Barthel Index and the Functional Independence Measure (FIM) are considered the two best scales. The Barthel Index screens for level of dependence in 10 categories of self-care and mobility. Only two categories, bladder and bowel control, do not require visual guidance. The FIM expands on the Barthel Index with a functional behavioral component, as well as a greater number and greater sensitivity of domains measured. The FIM evaluates 18 categories of function, of which 3 (bladder management, bowel management, and expression) do not require visual guidance. The National Institutes of Health Stroke Scale uses 11 elements, of which 6 tests are vision-based. The implication is that stroke patients are evaluated based on their ability to perform visually guided tasks. Their visual function may not be appropriately evaluated and treated, however, during the diagnostic and rehabilitative process (Table 1).

Conclusion

Based on this study, stroke patients have more vision impairments that can affect recovery than have been generally identified. For many of these patients, early diagnosis and intervention may affect the course of recovery and eventual level of independent function. Data from a larger population needs to be compiled. A standardized screening battery to identify vision disorders in stroke patients should be developed and tested for efficacy. Vision screening and early intervention strategies need to be developed so that they can be implemented by diagnosing physicians, occupational therapists, physical therapists, and other rehabilitation professionals. This will assist in identifying and diagnosing patients with handicapping vision disorders, thus enabling intervention to enhance the overall success of rehabilitation strategies. Additional studies are needed to evaluate the efficacy of intervention for vision disorders on the rehabilitation outcomes for stroke. Ultimately, more optometrists with the training and experience to work in rehabilitation facilities are needed to provide both testing and therapy for these patients.

References

1. Post-Stroke Rehabilitative Fact Sheet. NINDS. http://www.ninds.nih.gov. Last Accessed June 2, 2016.
2. The Agency for Healthcare Policy and Research Guideline for Post-Stroke Rehabilitation (AHCPR, 1995).
3. stroke.org. National Stroke Association's guide to choosing rehabilitation services. http://bit.ly/29Eg9Wy
4. Pollock A, Hazelton C, Henderson CA, Angilley J, et al. Interventions for disorders of eye movement in patients with stroke. Cochrane database of systematic reviews (online) 2011:10 (CD008389).
5. Stroke Statistics. http://uhnj.org/stroke/stats.htm. Last Accessed June 3, 2016.
6. Rowe F, VIS Group UK. Visual perceptual consequences of stroke. Strabismus 2009;17:24-8.
7. Rowe F, et al. Visual impairment following stroke: do stroke patients require vision assessment? Age Aging 2009;38:188-93.

8. Riise R, Gundersen B, Broday S, Bjerke P. Visual problems in cerebral stroke. Tidsskr Nor Laegeforen 2005;125:176-7 [Article in Norwegian].
9. Pollock A, Hazelton C, Henderson CA, Angilley J, et al. Interventions for visual field defects in patients with stroke. Cochrane Database Syst Rev 2011;10:CD008388.
10. Skenduli-Bala E, de Voogd S, Wolfs RC, van Leeuwen R, et al. Causes of incident visual field loss in a general elderly population: the Rotterdam study. Arch Ophthalmol 2005;123:233-8.
11. Pambakian A, Kennard C. Can visual function be restored in patients with homonymous hemianopia? Br J Ophthalmol 1997;81:324-8.
12. Townend BS, Sturm JW, Petsoglou C, O'Leary B, et al. Perimetric homonymous visual field loss post-stroke. Clin Neurosci 2007;14:754-6.
13. Gilhotra JS, Mitchell P, Healey PR, Cumming RG, Currie J. Homonymous Visual Field Defects and Stroke in an Older Population. Stroke 2002;33:2417-20.

Correspondence regarding this article should be emailed to Marsha Benshir, OD, at drbenshir@gmail.com.

Benshir MD. Prevalence of vision disorders after stroke: a pilot study to identify the visual needs of stroke patients. Optom Vis Perf 2016;4(4):128-32.

The online version of this article contains digital enhancements.