

## **FACT ABOUT FALLS**

1. Falls are the leading cause of injury deaths among individuals who are over 65 years of age.
2. By 2030, the population of individuals who are 65 years of age or older will double. By 2050, the population of individuals who are 85 years of age will quadruple.
3. In 200. Falls among elderly individuals accounted for 10,200 deaths and 1,600,000 emergency room visits.
4. 60 % of fall-related deaths occur among individuals who are 75 years of age or older.
5. 25% of elderly persons who sustain a hip fracture die within one year.
6. Hospital admissions for hip fractures among the elderly have increased from 231,000 admissions in 1988 to 332,000 in 1999. The number of hip fractures is expected to exceed 500,000 by 2040.
7. Annually, more than 64,000 individuals who are over the 65 years of age sustain a traumatic brain injury as a result of a fall.
8. Annually, 40,000 individuals who are over 65 years of age visit the emergency departments with traumatic brain injuries suffered as a result of a fall of which 16,000 of these individuals are hospitalized and 4,000 of these individuals die.
9. The rate of fall-induced traumatic brain injuries for individuals who are 80 years of age or older increased by 60% from 1989 to 1998.
10. The estimated total cost for non-fatal traumatic brain injury-related hospitalizations for falls in individuals who are 65 years of age or older is more than \$3,250,000.00. Two thirds of these costs occurred among individuals who were 75 years of age or older.
11. The costs to the Medicare and Medicaid programs and society as a whole from falls by elderly persons continue to climb much faster than inflation and population growth. Direct costs alone will exceed \$32,000,000.00 in 2010.

12. The federal government should devote additional resources to research regarding the prevention and treatment of falls in residential as well as institutional settings.
  
13. A national approach to reducing elderly falls, which focuses on the daily life of senior citizens in residential, institutional, and community settings are needed. The approach should include a wide range of organizations and individuals including family members, healthcare providers, social workers, architects, employers, and others.
  
14. Reducing preventable adverse events, such as elderly falls is an important aspect to the agenda to improve patient safety.

## **The Dizzy Person**

The goal of all healthcare providers and dizzy patients themselves is clearly combines in a participative intervention to prevent falls. We know that there is a very great neuronal complexity of what goes into the perception of “balance”. We know that there are age-related conditions that intercede with balance in the way of orthopedic, visual, and other neurological circuit problems. While we are discussing these situations, there are certain concepts that must be understood in the reading of this text.

“Peripheral” does not primarily indicate peripheral nervous system such as those nerves which come out and go into the spinal cord at various levels. Indeed, there are inputs into the ascending spinal cord from the “periphery”, (i.e. nerve endings that bring in messages from joint position sensors). External changes are also registered in the muscles as they contract and relax and the speed of that activity which is in a constant flow into the brain and the cerebellum. There are also skin touch receptors that are entering into this neuronal equation at all times. Indeed, however for the most part, in our discussion, we have used the term peripheral as synonymous with vestibular end organs, (semicircular canals), and cranial nerve (8) inputs into the pontomedullary junction vestibular nuclei. Again, terminology has to be utilized cautiously because the eighth nerve is of course the “auditory” nerve, but it also carries within it vestibular messages, which is what we are really concerned about for balance assessment.

It is crucial to understand that when we say “control” area, we mean “central” this being CNS, (i.e. the vestibular nuclei at the pontomedullary junction and their connections to the third, fourth, and sixth nerve nuclei, which are located in the mid brain and pons (CNS) themselves. We also have to realize that they are in play with brain frontal eye field control centers and parietal eye field centers in an ongoing manner. The receptive areas in the occipital cortex and the parietal cortex are interwoven in this ongoing split second process that involves literally millions of neurons. These circuits enable us to perceive balance and to accept balance and to accept the visual and auditory information inputs that we have to identify where we are in space and how we are moving in space. It is vastly complex physiology, one that we plan to make easy and understood. It is extremely important to keep the terminology correct.

If we are successful, we can indeed prevent falls and relieve our patients of pain and suffering from these falls. Ultimately, this is our goal. It is our goal to help interpret the video VNG and balance data collected in the vertiginous and dizzy patient. Noting that this is a clinical problem, which causes are often multiple and the etiology may in fact be physiological as opposed to structural, careful attention to the details is very important. The patient's clinical information must always be reviewed to aid the interpretation of the test results, so that you make the correct diagnosis.

We are going to point out what each and every test you do means and what the abnormalities are (if any). In some occasions, unfortunately, we will not be able to comment on the full test battery, because of the patient's inability to complete the entire testing battery, and on the occasion, technical difficulties may intervene as well. We will try to point to you how to decide whether the problem is within the central nervous system (brain stem and brain) or the peripheral input system, (i.e. the vestibular apparatus and eighth nerve as they come into the brain stem vestibular area). We will typically base a decision on the clinical data that is present as we view the test results.

Our goal in quality assurance is to teach you how to ask the right questions, how to read the complete testing protocol correctly, and how to individualize rehabilitation programs for each patient.

## **SECTION 2**

# CLINICAL HISTORY AND EXAMINATION

## EVALUATION OF THE DIZZY PATIENT

The current evaluation of the dizzy patient starts out with the question as to “what is the matter with you?” The physicians should then stop, wait, and LISTEN. Let the patient explain what is highest on their mind. Then present modifiers. How long has the dizziness been present? What makes it come and go? What affects the dizziness in anyway? What medications have you tried? What other doctors have you consulted with and what have they told you? What works best for you? What does not work for you? Does your heart race with dizziness? Do you have shortness of breath? Etc...

Specific questions should be asked such as a trend “is it getting worse or is it getting better? You should also know whether there have been any similar problems like this in the distant, remote, or even recent past.

Historically, when you are dealing with a dizzy patient, you have to understand there are many “culturally” accepted diagnoses. The first and worst of which is “inner ear infections.” The older and some younger doctors used to think it was mostly due to an actual bacterial infection, treatable by antibiotics. In fact, this means the patients is extremely vertiginous, dizzy with any postural change; it

lasts 3-4 days and typically goes away. This type of situation is not likely due to a bacterial infection but may possibly be a viral neuritis.

Postural dizziness is typically a benign condition (benign positional vertigo) with patients typically describing dizziness when they turn their heads too fast. This may well have something to do with the amount of endolymph and the small crystals within the ear canals (similar to sand particles and their ability to float up and down in the endolymph, be attached, or get stuck, etc). Certain balance studies can help make that differential diagnosis and there are a number of treatments available.

We have the time-honored "Meniere's Disease." Meniere's Disease is a typical triad of hearing loss, tinnitus and episodic intermittent vertigo, but not vertigo constantly. If the patient has this triad, this seems to be a fairly good diagnosis. It is often misdiagnosed and placed as a label on any person with dizziness. Once you label a patient, everyone stops thinking. If you are not sure, it can be harmful to the patient.

Simple drug and alcohol intoxications can certainly lead to dizziness and the feeling of dizziness. Too much imbibing has acute dizziness. This is usually temporary and is clearly related to alcohol intake. Some antibiotics (Gentamycin) can also be toxic to the 8<sup>th</sup> cranial nerve.

In any dizzy patient, you always have to worry about the "**basilar artery insufficiency**" Syndrome. These are typically older patients with a combination of dizziness, dim vision in both eyes, dysarthria, ataxia, weakness on one side and the other side or both-and an alternating numbness. These are symptoms of the Basilar Insufficiency Syndrome. Most of these people are going to be well over the age of 50. If you have an older patient who is having dizziness, beware of basilar artery insufficiency, and if you have a very young person, beware of labyrinthitis with B9 Position right and left vertigo.

**Acoustic neuromas** are always a worry and traditionally it takes form of speech understanding loss as its first clinical symptom, tinnitus, and dizziness later. When in doubt, get an MRI of the acoustic angle, so a BAER and there are audiologic that may help with this diagnosis.

Remember to start with "what is wrong with you" and then you listen. Ask modifying questions.

## **IN-OFFICE 1 MINUTE NEURO EXAM**

### **CLINICAL FUNCTION:**

The patient is talking to you, there is not aphasia and language symbolism is fine, nothing that you are utilizing the dominant frontal lobe, parietal lobe, and temporal lobe. Memory functions-Do you know what day it is, month, and year, President of the United States-show that the memory areas such as frontal and temporal areas are fine. What is the patient's emotional context?

### **CRANIAL NERVE EXAM:**

Some of this can be done by visual inspection. Are the patient's pupils equal, are the palpebral fissures equal, are the facies (naso-labial folds) equal, do the eyes move conjugately, there is no dysarthria of speech. If that is all normal, then probably the cranial nerves and their areas of origin in the brain stem are normal. Is any nystagmus present with the eye at rest or with movement?

## **MOTOR EXAM:**

Did the patient walk in normally? Did they sit down? Are they using their arms and legs well? Can they extend their feet if you ask them to do so? If they can, then the transmission system from the motor cortex down through the spinal cord out the peripheral nerves is working well.

## **CEREBELLAR EXAM:**

By observing if they can BALANCE. If the patient can stand with one foot in front of the other, crossing their hands in front and closing their eyes for 10 seconds, there is likely nothing wrong with the neuro-vestibular system. The patient understands what you have asked, they have the motor control to do this task, and they have the (sensory) proprioceptive inputs to do that.

## **2 MINUTE NEURO EXAM**

Unfortunately, sensory testing is mostly subjective. The patient has to tell you whether they feel a stimulus like touch, turning fork, cold, etc. A lot of times they will tell you “a little more or less” with a side-to-side comparison. A good sign a hysteria or malingering is put a turning fork on one side of the breastbone and then the other and see if there is any difference in vibration, that the other, if so, it is either hysteria or malingering. Bone conducts equally.

For a more complete exam (two-minute), do the Sensory Exam, and then you can check reflexes throughout in all for extremities, making sure they are not asymmetrical. Check for Babinski's. They are easy to do without having to remove a whole lot of clothing.

In a two-minute, good, thorough neuro exam in a dizzy patient, turn the patient around three times in one direction and observe for nystagmus (COWS), then hang the head over the exam table and turn 90 degrees left and right and observe for nystagmus.

## **PATIENT INFORMATION BROCHURE**

Dear Mr. or Mrs.,

As a patient of Dr. \_\_\_\_\_, you have been scheduled for balance laboratory testing. This complex testing will help your doctor determine why you are dizzy and off balance and perhaps falling. It will give your doctor valuable information; however, a lot depends upon your cooperation.

### **UNDERSTANDING THE BALANCE TEST**

Imbalance and falling is a very difficult problem. The human ability to maintain an erect posture and move about without becoming dizzy takes a lot of integration of the nervous system. The inner ear sends messages into the brain stem to tell us where we are in space. These will be tested, for example, by the “Dix-Hallpike” and other maneuvers. This is where your head is held in a down position while lying down and also by a stream of air, warm and cool, going into the ears to stimulate the ear drums. The other tests that we do will be more or less to find out whether the brain stem and brain balance mechanisms are working well. This call for you to visually track an object from side to side across a TV screen, looking at bars that go across the screen, have some testing done with your balance analysis on the FallTrak device as well. It is through this information for us to know how to treat you in a more precise manner.

## WHAT TO EXPECT

This test has to do a lot with vision and inner ear function. You will be supplied with a pair of goggles (not unlike the helicopter pilots used). These goggles let you see out of one eye and you will do certain maneuvers with them. One of the maneuvers is moving your head back and forth from left to right. Another of the maneuvers is moving your head up and down. You will also track a little hourglass figure on a screen and it will test how your eyes pursue different targets. Another test called the Dix-Hallpike maneuver is where with these goggles on you will be asked to lay down (you will have vision in one eye almost at all times) and turn your head from left to right. This allows the technician to see if there is any nystagmus (jerking) in the eyes, which might imply some problem with the inner ear mechanisms. Part of the test includes putting some warm and cold air into your ear. The inner ear is very sensitive to this. The eyes may then try to pull away. This test will be done only after your ear is inspected to make sure there is no wax build-up. It is always a very good idea to use Debroxc or Cerumenex the night or day before the test to ensure really clean ear canals. The test may have to be repeated if this is not done and wax is built up.

Part of the checking has to do with your standing on a balance measurement device. It is a large circle about one yard around and it is fixed in a very stable position. Once you have your balance, you will then follow with your body and eyes a moving target on a screen with the target going in circles (clockwise) and then (counter-clockwise). The floor pressure can be varied to make it somewhat moveable. Once you are balanced, the moveability will be tracked to see how good you can keep following a little circle (like the "PacMan") around with your body and feet moving this little platform in various directions. When you get good at it and if you enter balance therapy, training exercises, and done will allow you to be able to move the screen target in and out of a maze with the body movements. This "FallTrak" device will help train your balance. There is a rail in front of it that you can hold onto if needed. The technologist who is doing the test will watch you very carefully to make sure you do not become unbalanced.

We would like for you to fill out this 12 question form, which tells the doctor about some of your problems with dizziness, your inner ear and your balance. We will ask you to do one small maneuver putting one foot in front of the other to see how your balance is on a narrow base if you feel up to it.

We want you to feel perfectly at home and at ease having first read this information manual. Feel free at any time to ask the technologist any questions about it. They are quite familiar with the testing procedure. You are able to stop the test at anytime if you do not feel comfortable or able.

Please let us know at any time if you have any difficulties before, during, or after the studies. Most people do not have any difficulty whatsoever. Some of them even enjoy it as a fun workout on like a slow, walking treadmill machine.

PATIENT NAME: \_\_\_\_\_ DR. NAME: \_\_\_\_\_

PATIENT AGE: \_\_\_\_\_

## BALANCE AND DIZZINESS PATIENT WORKSHEET CLINICAL INFORMATION

The patient should answer the following questions:

- Question 1: What is your age? \_\_\_\_\_
- Question 2: Does the dizziness occur only when you move your head?      **Y**      **N**
- Question 3: Is the dizziness made worse by moving your head?      **Y**      **N**
- Question 4: Do you have any hearing loss?      **Y**      **N**
- Question 5: Do you have spells of dim vision in one or both eyes along with weakness on one side of the body with the dizziness?      **Y**      **N**



- Question 6: Do you have trouble saying your words with these dizzy spells? Y N
- Question 7: Do you ever experience imbalance with dim vision and trouble speaking or weakness of one or both sides of the body or numbness with dizziness? Y N
- Question 8: Have you ever had a major stroke? Y N When? \_\_\_\_\_
- Question 9: Have you ever had a transient ischemic attack (TIA) and what were the symptoms? Y N If yes, describe \_\_\_\_\_
- Question 10: Are you taking any medicines now that might make your blood pressure go down such as blood pressure medications? Y N Names \_\_\_\_\_
- Question 11: Have you ever taken the medicine Gentamicin or Streptomycin? Y N When was that? \_\_\_\_\_
- Question 12: Do you sometimes have heart irregularity? Y N

**The most important question is are you able to stand by yourself with one foot in front of the other, arms crossed, with eyes closed for 10 seconds?** If you think you can do it and have control and ability, let the operator know that. Make sure someone is watching you so that no injury or fall can occur. We do not want you to hurt yourself.

We thank you for your cooperation. This clinical information will help us to make a better diagnosis.

**Patient Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**VNG TESTING "AT A GLANCE" TESTING PROTOCOL**

<b><u>EYE COVER</u></b>	<b><u>TEST</u></b>	<b><u>CHAIR/TABLE</u></b>	<b><u>TIME</u></b>
NO	TRACKING Patient follows smooth target	CHAIR	20-25
NO	SACCADES Patient follows jump target	CHAIR	20-25
NO	OPK (RIGHT & LEFT) Patient follows columns (Create Nystagmus)	CHAIR	20
NO	DIRECTIONAL GAZE Patient stares at target in Four directions (Auto Start)	CHAIR	25
NO	HEAD ROTATION (HOR/VER) Patient 18" from Receiver-Swing head	CHAIR	25

	5 degrees with beeps		
YES	SPONTANEOUS Patient stares straight	CHAIR	20-25
YES	GAZE/FIX Patient looks at light thus Reducing nystagmus	CHAIR	20-25
YES	TORSION Move patient in swivel chair Head with body	CHAIR	20-25
YES	TORSION/FIX Move patient in swivel chair Looking at light inside goggle (Suppression)	CHAIR	20-25
YES	HALLPIKE (RIGHT & LEFT) Place patient in Long Sit. Turn patient's head. Bring patient down so head is 30 degrees below shoulder. Look for any Torsional Nystagmus.	TABLE	30-45
YES	SUPINE HEAD (CT,RT,LT) Lie patient on table/pillow. Record appropriate position.	TABLE	20-25
YES	BODY (RIGHT & LEFT) Turn patient on appropriate side Record for allotted time.	TABLE	20-25
YES	CALORICS (CT, CL, WR, WL) 1. Elevate patient's head 30 degrees 2. Turn head opposite of ear 3. Stimulate ear with air for 60 secs. 4. Turn head center 5. Start recording 6. After 30-35 secs ."Fixate" 7. After 20 secs. Of "Fixation" Stop *Let nystagmus suppress before advancing to next ear	TABLE	60

### **VNG "AT A GLANCME" DATA MARKINGS**

<b><u>TEST</u></b>	<b><u>CHANNEL (HOR/VER)</u></b>	<b><u>SEGMENT</u></b>
TRACKING	HORIZONTAL	Mark best symmetrical pattern (red & black lines look alike)
SACCADES	HORIZONTAL	Mark best symmetrical pattern (red & black lines look alike)
OPK'S (RT & LT)	HORIZONTAL	Mark highest SCV (slow component velocity) that is artifact free.

DIRECTIONAL GAZE	BOTH	Mark highest SCV that is artifact free *right & left are on horizontal and up & down is vertical
HEAD ROT.(HZ/VT)	BOTH	Scroll ½ to ¾ thru test (sinusoidal pattern) Mark. Software auto calculates
SPONTANEOUS	BOTH	Mark highest SCV, artifact free, always note vertical nystagmus.
GAZE/FIX	BOTH	Mark highest SCV, artifact free, normative data, data shows suppression of nystagmus.
TORSION value not	HORIZONTAL	Mark ½ to ¾ thru study. Mark data. Look for sinusoidal pattern. (Observation numerical present.
TORSION/FIX	HORIZONTAL	Mark ½ to ¾ thru study look for suppression of graph = normal.
HALLPIKE (RT/LT) or any	BOTH	Mark highest SCV artifact free. Mark after the onset (first 2-3 sec). Always note high vertical SCV patient discomfort.
SUPINE (CT, RT, LT)	BOTH	Mark highest SCV artifact free. Summarize or note any vertical nystagmus.
BODY (RT, LT)	BOTH	Mark highest SCV, artifact free. Summarize or note any vertical nystagmus.
CALORICS suppressed NOT suppress or	HORIZONTAL	Mark highest SCV prior to fixation. Scroll thru test observing that during fixation SCV had by approximately 50%. If SCV did had increased note in summary.

### **MARKING HINTS:**

Always mark data artifact free.

If you cannot capture both horizontal & vertical, either print full test graph of note in summary tab.

### **HOT BUTTONS:**

A	Auto Capture – resets camera
N	Advances to next test in protocol
Space Bar	Start & stops recording of data
M	Marks study
F	Applies fixation light in goggles (calorics)
U	Unmarks data

## **REHABILITATION INTRODUCTION:**

***All patients are different: Some will want to exercise longer than others (15-30 min) keep these rehabilitation exercises fun for the patients. Do not make it boring; then again, do not create exercises too difficult and frustrating for your patient. Also, set realistic goals for your patient. (i.e. if you have a 95 year old patient that scored 52%, don't expect a 90-100% score). Set your goal at 65-70%, you will be surprised what a 12-15% improvement will mean to you and your patients.***

1. Start off with the basics. Have the patient do a couple “static”, “dynamic”, and “LOS” exercises on a stable surface. Record their scores.
2. Do the same as above, with the “therapy foam” or the “therapy board” record their scores.
3. As the patient returns 2-3 times a week, you may increase or decrease the level of difficulty by selecting on the screen various speeds, cursor size, anterior, posterior vs. horizontal.
4. At the beginning of the second week of therapy (usually about 6-8 sessions). Repeat the four assessment studies. Chances are, you’re seeing improvement in the balance of your patient.

## **FALLTRAK “AT A GLANCE” PROTOCOLS**

### **BALANCE ASSESSMENT PROTOCOL:**

1. Enter all proper information needed (Name, Age, Height).
2. Have patient stand on Balance Plate as instructed in the Hand Book.
3. Have patient perform the four (4) basic tests:
  - A. Normal Stability Eyes Open
  - B. Normal Stability Eyes Closed
  - C. Perturbed Stability Eyes Open
  - D. Perturbed Stability Eyes Closed

**\*When applying perturbed surface always let the FallTrak unit calibrate out before the patient steps on the plate. Otherwise, data will not be saved.**

4. After assessment takes place, the FallTrak unit will calculate the patients propensity of falling by using the Limit of Stability formula.

### **Conclusion:**

Keep in mind therapy is time based. The more the patient is exercising, the more the central part of the nervous system is being trained. Don’t discount the assessment portion of the study. You may print out a patient copy of their improvement. Re-assessment is also very important with the patients you have performed “Vestibular Rehabilitation Therapy” on (Hallpike, Epley maneuvers, along habituation exercises). Along with VNG re-test the balance assessment will also show balance improvement associated with a vestibular dysfunction.

### **FALLTRAK HINTS:**

1. Always make sure the patient has on walking or running footwear.
2. If you do not have a hand rail. Place a standard tri-fold walker around the plate.
3. When doing Rehabilitation exercises (where the patient has to look at computer screen), make sure the screen is at eye level, you do not want your patients being re-trained to look up or down.
4. Go as long as the patient wants, remember longevity is improvement as well.