# Stroke Recovery: Rehabilitation, Recovery, and Complications

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## Disclosures

- I have nothing to disclose.

# References


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# Objectives

- At the end of this course, one should have:
  - A basic understanding of the stroke definition
  - A basic knowledge of stroke statistics
  - A basic knowledge of stroke complications
  - A basic understanding of neurorehabilitation of a stroke and the levels of stroke neurorehabilitation
  - A basic understanding of stroke rehab potential and prognosis
  - A basic understanding of stroke rehab treatments used for common but life changing complications of stroke
  - A basic understanding of stroke prognosis in the elderly
  - A basic knowledge of stroke recovery statistics

## Definition of Stroke

Any clinical disorder produced by a derangement of the cerebral circulation.

- **Non-Specific**
- **All-Inclusive**

## Nomenclature: General Classification

- **87% Ischemic Stroke:**
  - **Cerebral Infarction**
  - **Transient Ischemic Attack (minutes!!!)**
- **13% Hemorrhagic Stroke:**
  - **Intracerebral Hemorrhage**
  - **Subarachnoid Hemorrhage**

## Epidemiology

Background: Stroke Worldwide

- **Second most common cause of death (6.7 million deaths annually)**
- **Severe disabilities among the survivors. (30 million).**

## Epidemiology

Background: Stroke in the U.S.

- **Fifth leading cause of death**
- **800,000 new or recurrent strokes per year**
- **130,000 deaths per year**

## Epidemiology

Background: Stroke in the U.S.

- **An estimate 6.8 million people are living in the U.S. following a stroke.**
- **Leading cause of serious, long-term disability**
- **The current cost of stroke in the US is $34 Billion**

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## Subacute Stroke Treatment

-Subacute treatment of stroke occurs after the stroke and the acute stroke treatment.

-This involves the supportive care of the complications of the stroke.

-Acute stroke care, the ER, saves lives and improves morbidity, mortality, and recovery, however, most studies show that it's the subacute stroke treatment that occurs on the floor and elsewhere, that truly predicts stroke prognosis and recovery.

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# Subacute Stroke Treatment

- Treatment of any infections – studies show that infections can cause enough inflammation in the body to potentially cause strokes
  - Some institutions don't vaccinate during stroke admissions for this reason
- Treatment of underlying medical problems – in order to maximize rehab potential
- Treatment of PFOs, vascular problems

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# Subacute Stroke Treatment

- Treat stroke induced depression – improves rehab potential – may need psychiatry and neuropsychology
- Explain to family, goals of treatment is to prevent the next stroke, we can only "support" the active stroke, if the patient was not given TPA or had an intra-arterial intervention

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# Subacute Stroke Treatment

- Initiate rehab – PT, OT, and ST
- Watch for endurance with therapies and monitor therapists recommendations for rehab need and level following inpatient discharge
- Does rehab suggest assistive devices such as: canes, walkers, wheelchairs, orthotics, splints, etc

# Subacute Stroke Treatment

- Assess for spasticity vs flaccidity – will the patient need spasticity reduction with: oral meds, botulinum toxin, or baclofen pump vs will they need splinting for flaccidity?
- Monitor the patient's mood and apathy – do they want to get better? Do they want therapy? Do they want to give up and die?

# Complications of Stroke

-The American Stroke Association's website has great information on the complications of stroke for both physicians, families, and patients.

-Recognition and treatment of the complications of stroke will improve the patient's recovery and their overall neurorehab prognosis.

# Complications of Stroke

-Brain Edema – typically a problem in the first week
-Pneumonia – monitor for aspiration, treat as soon as diagnosed
  -High mortality
-Urinary Tract Infection (UTI) – needs to be treated
-Seizures – check EEG, then treat
-Depression – post stroke depression occurs often
-Pressure Ulcers – monitor closely
-Spasticity/Limb Contractures – can greatly affect rehab prognosis
-Flaccidity
-Shoulder Pain/Hemiplegia – monitor for subluxation
-DVT - treat

# Complications of Stroke

-Dizziness/Vestibular Problems – may require vestibular PT and/or OT

-Vision Changes – may require neuro optometry

-Persistent Aphasia

-Swallowing problems/Dysphagia – SLP and GI

-Gait Dysfunction

-Cognitive changes – OT, SLP, neuropsychology

-Pusher Syndrome/Lateropulsion – rehab techniques for this

-Neglect – rehab techniques for this

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# Complications of Stroke

In the rehab world, complications of a stroke are often referred to as "barriers."

There barriers can be symptoms or deficits that are a direct result of the stroke.

-The barriers can be premorbid conditions the patient has prior to the stroke.

-The barriers can be comorbid conditions the patient develops after the stroke.

-Typically these premorbid and comorbid problems are worsened by the stroke.

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# Neurorehabilitation of Stroke

- Most patients require some form of rehab following a stroke.
- Four main levels of rehab
  - -Inpatient Rehab – Inpatient Rehab Facility (IRF) or Inpatient Rehab Unit (IRU)
  - -Skilled Nursing Facility (SNF)
  - -Outpatient Therapy
  - -Home Therapy


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# Basic Levels of Rehabilitation

1. Inpatient Rehab Facility (IRF)
   - Rehab in a hospital setting, usually considered the most aggressive and superior to the rest
   - Typically reserved for the most severe strokes
   - Typically 3 hours per day, 6 days per week, with the potential for quick progression
2. Skilled Nursing Facility (SNF)
   - Less aggressive and typically used for those with a decreased level of endurance or those that will ultimately need SNF placement, usually < daily


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# Basic Levels of Rehabilitation

3. Outpatient Rehab
   - Usually used for patients with less severe strokes or those that have graduated from the other levels of rehab
   - Patients have to arrange transportation which can be difficult
   - Usually only 2 to 3 times per week but can be more or less
4. Home Rehab
   - Usually used for patients with less severe strokes without transportation, 2 to 3 times per week


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# Predictors of Rehab Potential

- In the rehab world these are called "barriers" to rehab
- Some patients are great candidates for rehab and others are not.
- There are many limitations/barriers for neurorehabilitation potential in patients with stroke and other neurological diseases
  - It's important to consider these when ordering rehab for our patients
- Knowing and recognizing all of a patient's rehab barriers, will allow you to predict a patient's rehab potential and ultimately their prognosis.


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# Barriers to Neurorehabilitation

- The number one barrier to rehab, for any disease, is the patient's desire to participate in rehab
  - In the elderly, if the patient does want therapy and their children do, this patient's rehab potential and prognosis will be very poor.
  - It's also important to choose rehab close to family, loneliness from friends and family can be a barrier
  - Convenience to home can be a barrier

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# Barriers to Neurorehabilitation

•Age can be large limitation/barrier to rehab, it can not be modified, of course, however, it should be recognized

- One of the biggest limiting factors for patients is endurance.
  - Following a stroke, patients typically need PT, OT, and ST
  - For inpatient therapy, plan 1 hour for each type of therapy, thus 3 hours per day

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# Barriers to Neurorehabilitation

- Remember, 3 hours a day of exercise can be difficult for "normal people" let alone stroke patients, think about this when ordering inpatient therapy
- Next limitation is co-morbidities:
  - COPD, CAD/MI, Seizures, PD, HTN, Depression, Anxiety, OSA, DM, DVTs, Infections, smoking/addictions, etc
  - When under control these are OK with rehab but therapies can be interrupted greatly when they are not

# Barriers to Neurorehabilitation

•Another limitation is nutrition, patients need adequate nutrition to rehab effectively, if dysphagic, we recommend PEG tube over NG and TPN for much better nutrition, poor nutrition usually means poor rehab

# Barriers to Neurorehabilitation

- Depression can limit rehab greatly, and strokes typically cause organic depression, if treated, patients typically rehab much better
- Mental status can limit rehab greatly too, obviously, a severely sedated person won't be able to participate in rehab but a perfectly healthy demented patient, who can't follow any commands, will not rehab well either, if at all


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# Barriers to Neurorehabilitation

- Other psychiatric issues can play a huge role in how well a patient rehabs
  - Typically we consult a neuropsychologist to help in assessing for these problems, which occur more often than you think and were never diagnosed before
- Pure sedation from a nondominant (usually right hemispheric stroke) can be a major limitation to rehab and we can give alerting medications for this


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# Barriers to Neurorehabilitation

- Sleep is a major limitation in therapy following a stroke, we need to start checking for more OSA following strokes
  - Day-Night Confusion falls into this category too
- Finally, some medications can be limiting factors in patients, mainly side effects
  - Usually we gear med changes around keeping the patient awake and able to participate in therapy
  - Abused drugs also fall into this category, ie cocaine, meth, ETOH

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# Barriers to Neurorehabilitation

- It's important to realize that inpatient rehab is not for everyone, especially if we can't change or treat these limitations
- Also realize that patients who can't tolerate inpatient rehab initially, may tolerate other forms first, and once they are "strong enough," we can admit to the inpatient unit.
- If these limitations are addressed prior to admission to the inpatient unit, the patient will rehab better and faster

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# Barriers to Neurorehabilitation

-Who is a neurorehabilitation candidate?

Anyone with a persistent neurological deficit who wants it to resolve

-This is true for strokes or any other type of neurological diseases

-It also helps to choose patients who want to get better, if they don't, they won't get better

-Some of the worst rehab candidates are the one's who have their families choose for them

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# Barriers to Neurorehabilitation

- When working in the rehab industry or when interpreting rehab studies, scales or scores are often used – they are used to follow a patient's progress and/or determine how well they are doing at the time of assessment
  - NIHSS
  - Modified Rankin Score
  - Functional Independence Measure

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# Modified Rankin Score

**MODIFIED RANKING SCORE**

| SCORE | DESCRIPTION |
|---|---|
| 0 | No symptoms at all |
| 1 | No significant disability despite symptoms; able to carry out all usual duties and activities |
| 2 | Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance |
| 3 | Moderate disability; requiring some help, but able to walk without assistance |
| 4 | Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance |
| 5 | Severe disability; bedridden, incontinent and requiring constant nursing care and attention |
| 6 | Dead |

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# NIH Stroke Scale

Figure 2. National Institutes of Health Stroke Scale

| Category | Score | Time | Score |
|---|---|---|---|
| 1a. Level of Consciousness (LOC) (Alert, drowsy, etc.) | 0 = Alert<br>1 = Drowsy<br>2 = Stuporous<br>3 = Coma | | |
| 1b. LOC Questions (Month, age) | 0 = Answers both correctly<br>1 = Answers one correctly<br>2 = Incorrect | | |
| 1c. LOC Commands (Open/close eyes, make fist & let go) | 0 = Obeys both correctly<br>1 = Obeys one correctly<br>2 = Incorrect | | |
| 2. Best Gaze (Eyes open – pt follows examiner's fingers or face) | 0 = Normal<br>1 = Partial gaze palsy<br>2 = Forced deviation | | |
| 3. Visual (Introduce visual stimulus/threat to pt's visual field quadrants. Cover 1 eye and hold up fingers in all 4 quadrants.) | 0 = No visual loss<br>1 = Partial hemianopsia<br>2 = Complete hemianopsia<br>3 = Bilateral hemianopsia | | |
| 4. Facial Palsy (Show teeth, raise eyebrows and squeeze eyes tightly shut.) | 0 = Normal<br>1 = Minor<br>2 = Partial<br>3 = Complete | | |
| 5a. Motor Arm – Left (Elevate extremity to 90 degrees and score drift/movement. Count to 10 out loud and use fingers for visual cue.) | 0 = No drift<br>1 = Drift<br>2 = Can't resist gravity<br>3 = No effort against gravity<br>4 = No movement<br>NT = Amputation, joint fusion (Explain) | | |
| 5b. Motor Arm – Right (Elevate extremity to 90 degrees and score drift/movement. Count to 10 out loud and use fingers for visual cue.) | 0 = No drift<br>1 = Drift<br>2 = Can't resist gravity<br>3 = No effort against gravity<br>4 = No movement<br>NT = Amputation, joint fusion (Explain) | | |
| 6a. Motor Leg – Left (Elevate extremity to 30 degrees and score drift/movement. Count to 5 out loud and use fingers for visual cue.) | 0 = No drift<br>1 = Drift<br>2 = Can't resist gravity<br>3 = No effort against gravity<br>4 = No movement<br>NT = Amputation, joint fusion | | |
| 6b. Motor Leg – Right (Elevate extremity to 30 degrees and score drift/movement. Count to 5 out loud and use fingers for visual cue.) | 0 = No drift<br>1 = Drift<br>2 = Can't resist gravity<br>3 = No effort against gravity<br>4 = No movement<br>NT = Amputation, joint fusion (Explain) | | |
| 7. Limb ataxia (Finger to nose, heel down shin) | 0 = Absent<br>1 = Present in one limb<br>2 = Present in two limbs | | |
| 8. Sensory (Pin prick to face, arms, trunk, and legs. Compare responses side to side, or no feeling at all.) | 0 = Normal<br>1 = Partial loss<br>2 = Severe loss | | |
| 9. Best Language (Name items, describe picture, and read sentences. Don't forget glasses if they normally wear them.) | 0 = No aphasia<br>1 = Mild to moderate aphasia<br>2 = Severe aphasia<br>3 = Mute | | |
| 10. Dysarthria (Evaluate speech clarity by pt reading or repeating words on list.) | 0 = Normal articulation<br>1 = Mild to moderate dysarthria<br>2 = Severe to unintelligible or worse, or mute/anarthric or other physical barrier<br>NT | | |
| 11. Extinction and Inattention (Use information from prior testing or double as multisensory stimuli testing to identify neglect. Tests: arms, legs and visual fields.) | 0 = No neglect<br>1 = Partial neglect<br>2 = Complete neglect | | |
| NT= Not testable acceptable as motor stroke | | | |
| TOTAL SCORE: | | | |

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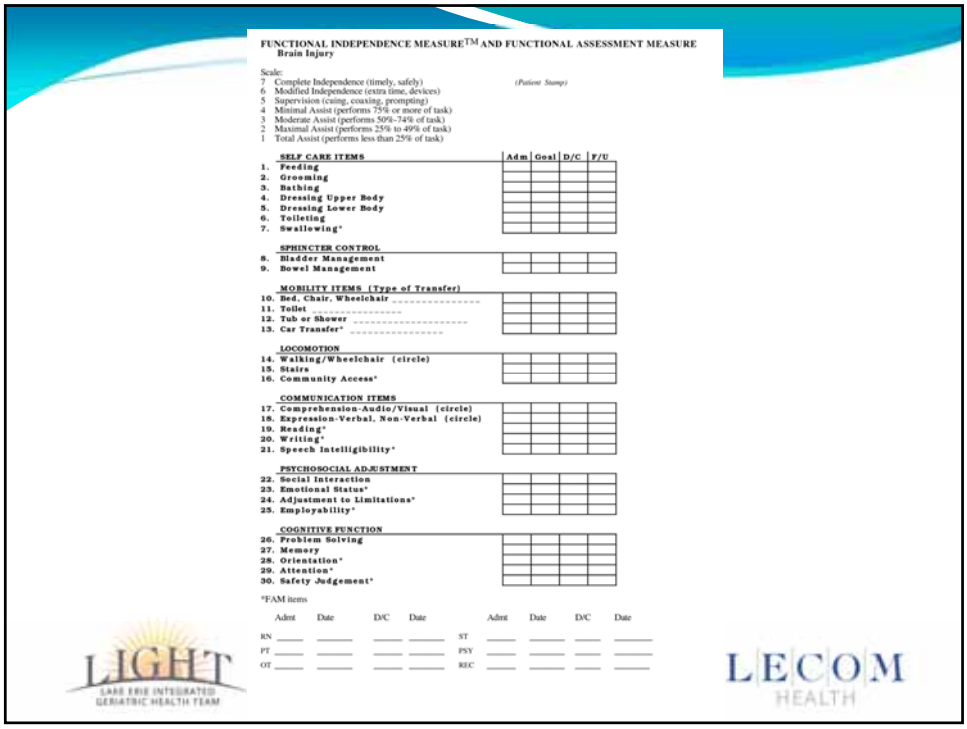

FUNCTIONAL INDEPENDENCE MEASURE™ AND FUNCTIONAL ASSESSMENT MEASURE
Brain Injury

Scale:
7 Complete Independence (timely, safely)
6 Modified Independence (extra time, devices)
5 Supervision (cuing, coaxing, prompting)
4 Minimal Assist (performs 75% or more of task)
3 Moderate Assist (performs 50%-74% of task)
2 Maximal Assist (performs 25% to 49% of task)
1 Total Assist (performs less than 25% of task)

(Patient Stamp)

| SELF CARE ITEMS | Adm | Goal | D/C | F/U |
|---|---|---|---|---|
| 1. Feeding | | | | |
| 2. Grooming | | | | |
| 3. Bathing | | | | |
| 4. Dressing Upper Body | | | | |
| 5. Dressing Lower Body | | | | |
| 6. Toileting | | | | |
| 7. Swallowing* | | | | |
| **SPHINCTER CONTROL** | | | | |
| 8. Bladder Management | | | | |
| 9. Bowel Management | | | | |
| **MOBILITY ITEMS (Type of Transfer)** | | | | |
| 10. Bed, Chair, Wheelchair | | | | |
| 11. Toilet | | | | |
| 12. Tub or Shower | | | | |
| 13. Car Transfer* | | | | |
| **LOCOMOTION** | | | | |
| 14. Walking/Wheelchair (circle) | | | | |
| 15. Stairs | | | | |
| 16. Community Access* | | | | |
| **COMMUNICATION ITEMS** | | | | |
| 17. Comprehension-Audio/Visual (circle) | | | | |
| 18. Expression-Verbal, Non-Verbal (circle) | | | | |
| 19. Reading* | | | | |
| 20. Writing* | | | | |
| 21. Speech Intelligibility* | | | | |
| **PSYCHOSOCIAL ADJUSTMENT** | | | | |
| 22. Social Interaction | | | | |
| 23. Emotional Status* | | | | |
| 24. Adjustment to Limitations* | | | | |
| 25. Employability* | | | | |
| **COGNITIVE FUNCTION** | | | | |
| 26. Problem Solving | | | | |
| 27. Memory | | | | |
| 28. Orientation* | | | | |
| 29. Attention* | | | | |
| 30. Safety Judgement* | | | | |

*FAM items

| | Admit | Date | D/C | Date | | Admit | Date | D/C | Date |
|---|---|---|---|---|---|---|---|---|---|
| RN | | | | | ST | | | | |
| PT | | | | | PSY | | | | |
| OT | | | | | REC | | | | |

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# Stroke complications and the rehab treatments used.

-I will now discuss rehab treatments for common stroke complications.

-Often these complications go unrecognized, for a time, and if not treated, these complications can have devastating results on a patient's rehab prognosis, recovery, and a return to independence.

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# Stroke complications and the rehab treatments used.

-The complications that will be discussed:

- -Pusher Syndrome (Lateropulsion)
- -Shoulder pain with associated hemiplegia
- -Spasticity
- -Hemiplegia/Hemiparesis - CIMT
- -Vestibular (Balance) Problems/Dizziness
- -Neglect



# Pusher Syndrome (Lateropulsion)

-Usually from Right Hemispheric Strokes

-Patient pushes to contralateral side of stroke

-Not to be confused with medullary strokes that “push” to the ipsilateral side

-Lower motor scores with lateropulsion, Fugal-Meyer, FIM, Barthel

-Increased lengths of stay, on average need about 3.6 weeks more for rehab vs. other strokes

# Lateropulsion

-"The Visual Vertical," patient's concept of vertical line is skewed to the same angle as the "push"

-They push that way because the brain thinks that angle is upright, the brain always tries to keep the eyes upright

-Lateropulsion is a motor behavior comprised of 3 parts: graviception, vision, and body axis

-The patient needs to realize that if they keep pushing, they will fall over, usual basis for therapy

# Lateropulsion

-Usually associated with neglect, and pushes to the neglected side

-Ways some IRF's tested for and measured the push:

-Sat patient in a wheel, blindfolded (vision taken out) and move the patient towards the push until they said they felt upright and then measured the angle off midline

-Another hospital performed a similar test with a chair that could move like a wheel

-Ask the patient to draw a vertical straight line

# Lateropulsion

-Scales for lateropulsion:

- Scale for contraversive pushing
  - Melbourne Pusher Scale (0-3)
  - Swedish Scale for Contraversive Pushing
  - Burke Lateropulsion Scale (0-17), performed supine

-Treatments:

-Show patient that if they keeps pushing, they'll fall

-Vision can help compensate for this but requires training

# Lateropulsion

-Treatments:

- Standing therapy – "Auto-Ambulator"
- Heel Lifts
- Mirror therapy – can be profound when the patient finally recognizes how much the stroke has affected them

# Shoulder Pain and Hemiplegia

-Shoulder pain on the hemiplegic side is very common following stroke

-An exact etiology is unknown but is believed to be caused by flaccidity, spasticity, subluxation, and sensory loss (proprioception) and then a return of strength and sensation

-Usually seen in weeks to months following a stroke, but can be seen in days

# Shoulder Pain and Hemiplegia

-Studies have shown that both flaccidity and spasticity can occur in strokes up to 85% of the time depending on what author you read, therefore their incidence is equal, although, flaccidity usually occurs first, if at all, and lasts only a short time

# Shoulder Pain and Hemiplegia

-Subluxation usually occurs with a flaccid joint with weak supraspinatus and deltoid muscles causing a downward and outward slide of the humerous

-Flaccidity of the trapezius, rhomboids, and serratus anterior muscles leads to depression, protraction, and downward rotation of the scapula, which leads to significant angular changes of the glenoid fossa, subsequently contributing to subluxation.

# Shoulder Pain and Hemiplegia

-Also, the spine begins to flex laterally toward the hemiparetic side because of the elimination of the righting reflex, further altering the scapulothoracic relationship.

# Shoulder Pain and Hemiplegia

-When the arm and shoulder move correctly, the scapula should move with the arm, but in the case of shoulder subluxation, the arm moves while the scapula stays in place.

-This is a typical cause of pain in patients because the proximal arm muscles, mainly the deltoid, become pinched against the acromion.

# Shoulder Pain and Hemiplegia

-In addition, in this state, the joint capsule is very unstable and can be easily damaged

-Studies have shown that stretching the arm and the capsule can result in irreversible damage, our order sets state “don’t pull on affected arm”

-When a subluxed joint becomes spastic, this too can lead to pain because the joint becomes misaligned

# Shoulder Pain and Hemiplegia

-Some quick and easy ways to check for a subluxation include:

1. Simple palpation, some are so severe that you can feel the ball of the humerous bulging
2. With active or passive ROM, place your hand on the patients scapula, and you should feel it rotate up with the arm, if it doesn't and the patient complains of pain, it's probably subluxed
3. Patient complains of shoulder pain on the hemiplegic side

# Shoulder Pain and Hemiplegia

-Work Up

- Ask the PT and/or OT to assess the shoulder
- Get an X-Ray to rule out fracture, the patient may have fallen during the stroke
- If all else is negative, consider ordering a uric acid level to rule out gout (usually affects smaller joints but can occur in larger joints

# Shoulder Pain and Hemiplegia

-Treatment:

- Many different techniques have been tried but the one agreed upon by everyone is to support the joint with either a table or an arm trough on the wheelchair and then continue with therapy to strengthen the joint
- Pillows and foam rubber can be used short term, while waiting for a table or trough

# Definition of Spasticity

-Spasticity

-Is a disorder of the central nervous system (CNS) in which certain muscles continually receive a message to tighten and contract.

-The nerves leading to those muscles, being damaged and unable to regulate themselves (which would provide for normal muscle tone), permanently and continually "over-fire" these commands to tighten and contract.

-This causes stiffness or tightness of the muscles and may interfere with gait, movement, and speech.

-Is velocity dependent

- The faster the PROM, the decreased ROM of the joint

## Spasticity is often confused with rigidity.

-Rigidity describes an increase in muscle tone, leading to a resistance to passive movement throughout the range of motion.

-There are different types of rigidity: cogwheel rigidity (jerky resistance), lead pipe rigidity (continuous rigidity), spastic rigidity (rigidity is rate dependent and only elicited upon a high speed movement).

-These various forms of rigidity can be seen in different forms of movement disorders such as Parkinson's Disease.

## Spasticity vs Rigidity

-Spasticity is a word that describes a state in which the muscles are in a persistent state of increased involuntary reflex activity in response to a stretch.

-You may observe the following in a person with spasticity: hypertonia, hyperactive deep tendon reflexes, clonus, and a spreading of the reflex response beyond the muscles that were stimulated.

# Spasticity vs Rigidity

-The term rigidity is used to describe an involuntary increase in resistance of a muscle to passive stretch that is uniform though out the range of motion (ROM) of the muscles being stretched and which is not velocity dependent.

-Rigidity and spasticity are often confused and are very hard to tell apart but they are tow separate and distinct phenomena. In rigidity deep tendon reflexes are not hyperactive as they are in spasticity.

# Ways to Measure Spasticity

-Ashworth Scale:

1 No increase in muscle tone.

2 Slight increase in tone giving a "catch" when affected part is moved in flexion or extension.

3 More marked increase in tone but affected part is easily flexed.

4 Considerable increase in tone; passive movement difficult.

5 Affected part is rigid in flexion or extension.

# Ways to Measure Spasticity

*Modified Ashworth Scale*

- *0 No increase in tone*
- *1 Slight increase in muscle tone, manifested by a catch and release or minimal resistance at the end of the ROM when the affected part(s) is moved in flexion or extension*
- *1+ Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM*
- *2 More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved*
- *3 Considerable increase in muscle tone, passive movement difficult*
- *4 Affected part(s) rigid in flexion or extension*

# Manifestations of Spasticity

Muscle tightness, rigidity

Muscle spasms

Abnormal postures

Arm flexed, hand fisted

Foot pushed down

Altered movement patterns

Lean to swing hip while walking

# Spasticity after Stroke

Sommerfield, 2003

Stroke unit survivor study

3 months after stroke

Spasticity

- -19% of patients
- -Worse motor scores
- -Worse activity scores

Watkins, 2001

Community prevalence study

12 months after stroke

Spasticity

- -38% of patients
- -More impaired

## What are the disadvantages of Spasticity?

Limited movement of arms and legs

Inability to walk properly

Difficulty using hands to dress, bathe, eat, etc.

Painful spasms

Painful deformities/contractures

Skin sores

## What are possible advantages of Spasticity?

Helps support circulatory function

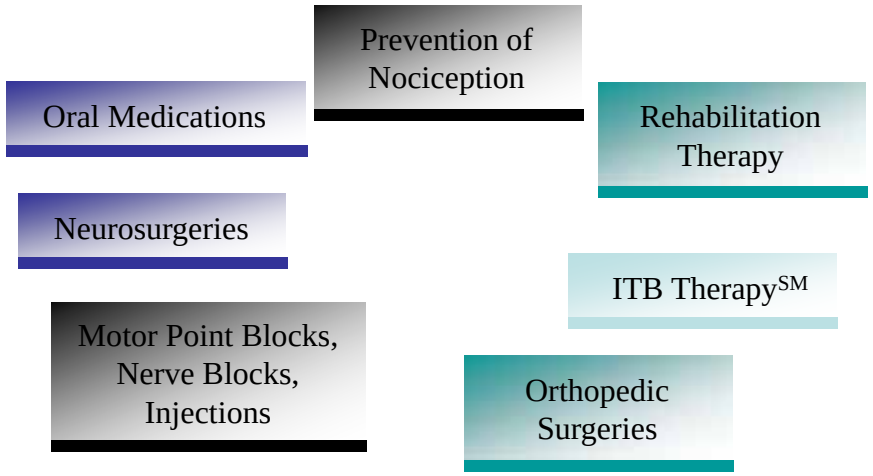
May prevent formation of deep vein blood clots

People may become used to relying on their spasticity while doing activities of daily living

## Spasticity: Appropriate Referrals

Rehab
PT
OT
Speech
Neurology
Physiatry (PMR)
Neurosurgeon
Orthopedic Surgeon

## Spasticity: Management Options




## *Spasticity: Management Options*

-Prevent nocioception (response to certain harmful or potentially harmful stimuli)

-Physiotherapy

-Surgery

-Neurosurgery/Orthopedic

Motor point blocks

Botulinum, formaldehyde

Intrathecal baclofen

Oral Medications

- Baclofen (Lioresal)
- Tizanadine (Zanaflex)
- Benzodiazepines
  - Diazepam (Valium)
  - Clonazepam (Klonopin)
- Dantrolene

## Spasticity: Neurorehabilitation

Can have a profound effect on spasticity

Can be used alone or as an adjunct therapy

Typically has a synergistic effect with the other forms of management

## Spasticity: Neurorehabilitation

Gait therapy –evaluate and improve a spastic gait, offer strategies to improve

Constraint Induced Therapy (CIT/CIMT) - impede movement of the good side to improve and speed up therapy on the affected side

Stretching -an achieve great results using other management methods

## Spasticity: Neurorehabilitation

Splinting:

-Usually used at night for mild to moderate cases, but can be used at all times for the severe cases

Serial Casting (usually requires inpatient therapy):

-Cast the contracture into a functional or less painful position, works well with Botox, oral baclofen, ITB

## Spasticity: Neurorehabilitation

-Inpatient stays are great for safe titration of medications and can add the synergistic effect of therapy

-Patients with spasticity in their bodies often have "spastic speech" and/or dysphagia, and a speech therapist can be very helpful with improving these deficits

-Therapists often can spend more time with the patients vs physicians, and may discover more problems than originally found

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## Spasticity: Neurorehabilitation

-Therapists are able to assist in ordering the appropriate medical equipment to treat spasticity and are able to set up a patient’s home to become a safe environment

-Therapists can also be invaluable in helping discover if decreasing spasticity may be detrimental to the patient’s ability to ambulate and perform ADLs/ILS

# Treatment of Spasticity

Referral to Spasticity Specialist
Oral Management/Rehab
Possible Additional Injections
Following Failure/Near Failure of Oral Medications
Injections
ITB
Surgery
Rehab
Combination of above treatments.

# Oral Medications for Spasticity

Baclofen (Lioresal)
Tizanadine (Zanaflex)
Benzodiazepines
Diazepam (Valium)
Clonazepam (Klonopin)

Effective at higher doses
Easy to prescribe
Sedation, fatigue
Cognitive side-effects
Habituation, withdrawl
Impaired motor function, "ataxia"

## Oral Medications for Spasticity: Dantrolene

Acts at muscle fiber
Titrate slowly
Effective, especially for clonus
Less sedation

Weakness
Liver toxicity
Dizziness
Drowsiness
Diarrhea

Also can be used for neuroleptic malignant syndrome.

## Local Denervation Treatments for Spasticity

Need to inject muscle by muscle
Local anesthetics
Short term
diagnosis/analysis
- Spasticity or contracture?
- Which muscles participating in spasticity?

Phenol
Botulinum toxin

## Phenol Injections for Spasticity

Advantages
- Immediate onset
- Long lasting (1 year)
- More difficult to inject
- Large muscles
- Inexpensive

Adverse effects
- Pain at injection sites
- Leg swelling
- Blood clots
- Skin sloughing
- Excessive weakness

## Botulinum Toxin Injections for Spasticity

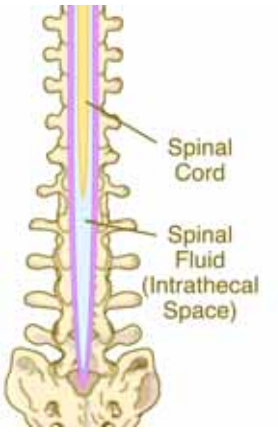
- Onset 12-72 hours
- Lasts 3 months
- Easy to administer
- Need very high doses for large muscles
- Cost
- Neutralizing antibodies
- Loss of efficacy over time

Adverse Effects
- Weakness
- Local skin reactions
- Used in small muscle groups after other treatments have been optimized.

## Sometimes medicine needs to be given intrathecally

Intrathecal medication is different from oral medication because it delivers a liquid form of medicine directly to the fluid around the spinal cord

Because it does not circulate throughout the body, it may require less medication and help minimize side effects typically seen with oral medications



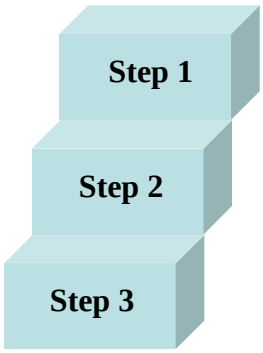

## Intrathecal Baclofen Therapy: Technology

- Pump implanted in abdomen
- Catheter runs into spinal canal
- Slowly infuse baclofen into the spinal canal
- Dosage envelope can be shaped
- Transcutaneous refill Q 4-26 weeks

# The Steps of ITB Therapy

- **Step 1:** Screening Test
- **Step 2:** Pump Placement

**Step 3:** Therapy Adjustment and Maintenance




# ITB: Baclofen Screening Test

Lumbar puncture.

Inject 25-150mcg (50-100) baclofen IT.

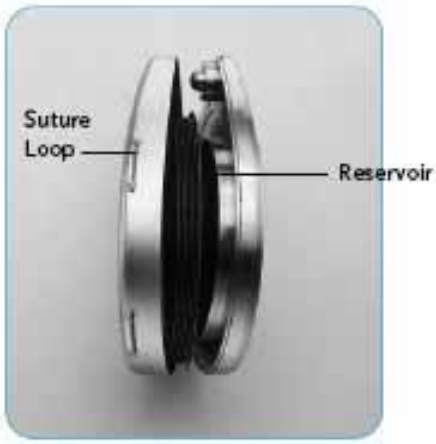
Record baseline and Q 1 hour spasticity (Ashworth) scores.

If clear improvement, proceed with pump implant.

If no improvement, consider repeat test with higher dose of baclofen.

Gives estimate of initial dose

# Intrathecal Baclofen Pump




# Intrathecal Baclofen: Results

-86% benefit in cerebral origin spasticity (screening test)

-Stroke, brain injury, cerebral palsy

Spasticity – 1 - 3 point average improvement (Ashworth scale) in MS, spinal cord injury, stroke, and cerebral palsy.

Decreased number of muscle spasms.

Improved walking speed in hemiplegic stroke (36.6-52 cm/sec).

Improved quality of life measures.

Decreased pain in severe patients.

## Intrathecal Baclofen: Complications

- Pump, catheter infection
- Spinal headache
- Pump failure
- Catheter leak, breakage, migration
- Pump "flip"

## Intrathecal Baclofen: side-effects

Baclofen Overdose

- Drowsiness
- Lightheadedness
- Dizziness
- Somnolence
- Respiratory depression
- Seizures
- Rostral progression of hypotonia
- Loss of consciousness progressing to coma

Baclofen Withdrawal

- Pruritus without rash
- Hypotension
- Paresthesias
- Fever
- Altered mental state
- Exaggerated rebound spasticity and muscle rigidity, rhabodmyloysis, and multiple organ failure

## ITB Summary

| | Benefit | Complications/SE |
|---|---|---|
| ITB | 1-3 point better Ashworth scale<br><br>Improved walking speed<br>Markedly decreased spasms<br>Improved pain, hygiene | Infection - uncommon<br>Catheter leaks - rare<br><br>Constipation<br>Sedation<br>Withdrawl |

## Spasticity Summary

Several treatments are now available

Rehabilitation

Oral Medications

Injections

Intrathecal Baclofen

Surgery

# Constraint-Induced Movement Therapy (CI, CIT, or CIMT)

CIMT is a form of therapy that helps patients with a stroke or other neurological disorder regain the use of affected limbs.

-Developed at the University of Alabama in Birmingham by Dr. Edward Taub.

The focus of CI lies with forcing the patient to use the affected limb by restraining the unaffected one.

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# CIMT

- The affected limb is then used intensively for either three or six hours a day for at least two weeks.

- As a result of the patient engaging in repetitive exercises with the affected limb, the brain grows new neural pathways.

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# CIMT

- Taub argues that, after a stroke, the patient stops using the affected limb because they are discouraged by the difficulty.
- As a result, a process that Taub calls "learned non-use" sets in, furthering the deterioration.
- It is this process that CI seeks to reverse.

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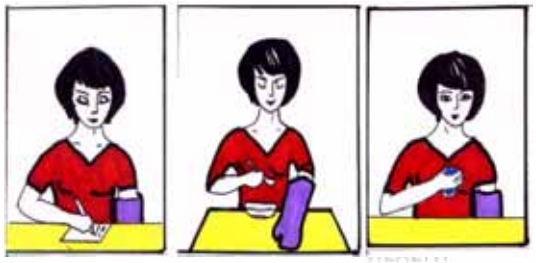
# CIMT

- Usually restrict the good extremity for 90% of waking hours, usually for 2 weeks
- Some studies show this works 18 years or more past stroke



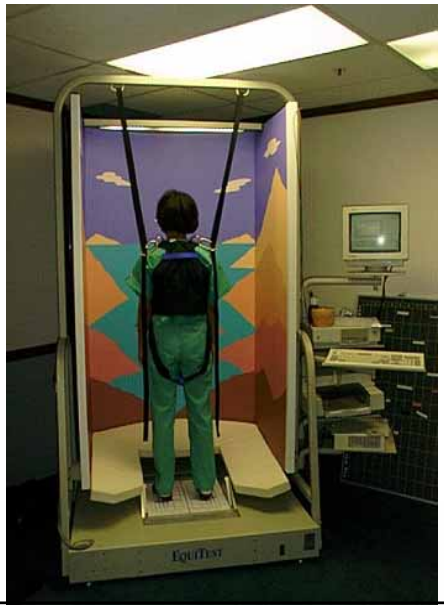
# Vestibular Rehabilitation

- Vertigo/Dizziness can be one of the most frustrating diseases to treat for both the patient and the physician
- It's usually a combination of problems, both peripheral and central

# Vestibular Rehabilitation

- Other studies that can be performed include:
  - Electronystagmogram (ENG)
  - Full vestibular study with Videonystagmogram (VNG), rotary chair and posturography
  - Dix-Hallpike Testing
  - Audiological evaluation – especially if the patient has aural fullness, tinnitus, and/or hearing loss
  - ENT referral

# Vestibular Rehabilitation




# Vestibular Rehabilitation

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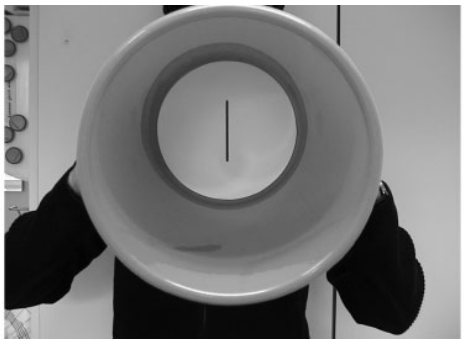

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# Vestibular Rehabilitation

- All treatment of vertigo begins with a referral to a vestibular trained PT or OT

- If the patient doesn't receive therapy for their vertigo, it will come back or they will never fully compensate for the vertigo

# Vestibular Rehabilitation

- The therapists will also check for a co-morbid peripheral vestibulopathy; and they can perform both Dix-Hallpike and Head Roll tests and then go directly into Epley Maneuvers which will treat the vertigo

- After that, the therapists will continue with vestibular rehab and gait/balance training

# Vestibular Rehabilitation

- Medications for central vertigo:
  - Meclizine (Antivert) 12.5 to 25 mg TID to QID - ?
  - Ativan 0.5 to 1 mg TID (works better for strokes)
  - Klonopin 0.25 to 0.5 mg BID (works better for strokes)
  - Valium 5 mg BID
  - Phenergan 12.5 to 25 mg TID
  - Compazine 10 mg TID
  - Zofran



# Neglect

-Unilateral Spatial Neglect is not one syndrome, it's a combination of three separate entities (basically, motor, sensory, and attention)

-Spatial Rightward Bias – Attention, perception, imagery, clock draw is a good test for this

-Nonlateralized deficits – arousal and capacity – can't process multiple objects or objects in time


# Neglect

-Visual Neglect – main areas affected are the dorsal parietal lobe and occipital cortex

-The dorsal network mediates the lateral portion of the spatial awareness

# Neglect

-Persists much longer when it occurs in the right hemisphere, dominance not affected

-Most common areas on fMRI include the right frontal and right temporoparietal lobes

# Neglect

-Two models commonly used to assess neglect:

-Karnath's Site of Spatial Awareness

-Mesulam's Model of Spatial Neglect

-Neglect is extremely under diagnosed and sometimes very subtle



# Neglect Treatments

-Transcranial magnetic stimulation (TMS) can be used for rebalancing spatial neglect

-Prism Treatment (Glasses/Goggles) will help with visual-spatial neglect, but not with attentional neglect – inconsistent, should improve in patient's own environment, but doesn't

-Dopamine has been shown to improve neglect, levodopa/carbidopa or dopamine agonist, bromocriptine and apomorphine have also been shown to work

# Neglect Treatments

-"Where Neglect," can be improved with monocular patching, side doesn't matter

-Always place patient's neglected side towards the door, forces stimulation

-Reperfusion – One study showed that if SBP could be safely kept between 180 and 220 following a stroke, then neglect would resolve rapidly


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# Neglect Treatments

-The penumbra directly correlates with the severity of the neglect, not the volume of the stroke

-Enhancement of training effects

-DC current stimulation

-Direct anodal stimulation caused the greatest affect and thereby increased and reinforced training


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## Stroke Prognosis and Recovery in the Elderly

-There are 5 studies that researched stroke prognosis and recovery.

-Canadian Study, Danish Study, Israeli Study, Korean Study, and American Study


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## Stroke Outcomes in those over 80

- Canadian Study, published 2008, reference #2
- Looked at 7 day stroke fatality, discharge home to pre-stroke residence, and length of hospital stay (LOS)
- Less than 59 yo – 3.3% 7 day fatality, 66.8% were discharged to their pre-stroke residence, 6 day LOS
- 60-69 yo – 4.6% 7 day fatality, 63.7% were discharged to their pre-stroke residence, 7 day LOS
- 70-79 yo – 6.9% 7 day fatality, 58.0% were discharged to their pre-stroke residence, 8 day LOS
- Greater than 80 yo – 11.2% 7 day fatality, 47.2% were discharged to their pre-stroke residence, 10 day LOS


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## Rehabilitation following stroke in patients aged 85 and above

- Israeli study, published 2005, reference #3
- Looked at FIM scores and rehab hospital LOS
- 85 yo and older – Pre-stroke FIM = 117 +/- 12, post-stroke FIM = 64 +/- 20, LOS was 21 +/- 11 days and 80% went home
- 75 to 84 yo – Pre-stroke FIM = 118 +/- 13, post-stroke FIM = 66 +/- 20, LOS was 23 +/- 11 and 88% went home
- They felt age really was not a factor if patients were carefully selected for rehab
- Only study that really showed age was not a factor in rehab prognosis

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## Short- and long-term prognosis for very old stroke patients. The Copenhagen Stroke Study

- Danish study, published 2004, reference #4
- 85 yo and older (88 yo mean) – 58.6% died or were discharged to a nursing home, 35.6% had an inpatient mortality rate
- Less than 85 yo (71.7 yo mean) 31.2% died or were discharged to a nursing home, 18.1% had an inpatient mortality rate
- For the 85 yo and older, 5 years following the stroke, 91.6% of the patients had died or were nursing home residents
- For the less than 85 yo, 5 years following the stroke, 67.6% of the patients had died or were nursing home residents

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# Ischemic Stroke Prognosis in Adults

- From www.uptodate.com, last updated on December 28, 2015, reference #5
- "Acute phase predictors of stroke prognosis are stroke severity and age"
- Great recovery occurs between 3 and 6 months, and recovery can occur up to 18 months
- Estimated 30 day fatality rate after the first ischemic stroke ranges from 16% to 23%
- "In patients that are 12 hours to 7 days out from their stroke, who experience no complications, experience moderate and steady improvement in their neurological deficits."

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# Long-Term Outcomes of Acute Ischemic Stroke in Patients Aged 80 Years and Older

- Korean study, published 2008, reference #6
- It looked at the mean duration of estimated survival following a stroke
- 80 - 84 yo - 24 +/- 6.4 months
- 85 – 89 yo – 8 +/- 7.3 months
- 90 – 94 yo – 7 +/- 2.0 months

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# Stroke Prognosis in Elderly Patients

- As you can see, stroke prognosis is based on many factors
- Most studies show that stroke severity and age are the some of the largest factors
  - Stroke severity is measured by the persistent NIHSS (NIH Stroke Scale) that the patient has at discharge
- The administration of TPA, improves overall prognosis as well, even if no improvements are seen in the initial hospital stay
- Most studies show that stroke treatment on the floors, not the ER, is the best way to predict how well a patient will do on discharge
- Every stroke and every patient is different in predicting prognosis



# Overall Stroke Recovery

From *The National Stroke Association's* website:

10% of stroke survivors recover almost completely

25% recover with minor impairments

40% experience moderate to severe impairments requiring special care

10% require care in a nursing home or other long-term care facility

15% die shortly after the stroke


# Questions?


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