Gait and Functional Mobility in Stroke
*Bridging Evidence into Practice*

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**OBJECTIVES**

1. Participants will be able to identify the most effective patient care setting for improved outcomes post-stroke, based on current evidence.

2. Participants will be able to identify the most effective interventions for post-stroke gait and functional mobility deficits, based on current evidence.

3. Participants will be able to design a treatment plan for patients post-stroke, using practical approaches to evidence based interventions.
STROKE STATISTICS

1. Each year approximately 795,000 people have their first or a recurrent stroke.
2. It is the fourth leading cause of death and leading cause of long term disability in adults.
3. For Medicare patients discharged from the hospital after stroke, ≈45% return directly home, 24% are discharged to inpatient rehabilitation facilities, and 31% are discharged to skilled nursing facilities (Go, Mozaffarian, Roger 2014)

STROKE STATISTICS

A study of ischemic stroke survivors who were ≥ 65, found that 6 months post stroke:
1. 50% had some hemiparesis
2. 30% were unable to walk without some assistance
3. 26% were dependent in activities of daily living
4. 26% were institutionalized in a nursing home

A survey of stroke survivors in 21 states found that only about 30 % received out-patient rehabilitation (Go, Mozaffarian, Roger 2014)
Evidence on Stroke Rehabilitation

**What is the most effective type of care post-stroke?**

Specified Acute Stroke Care and Stroke Rehabilitation programs have been shown to be most effective in the treatment of stroke.

**Strong level 1a evidence that dedicated acute care stroke units**:
1. Reduce the need for institutionalization
2. Show a reduction in death rates from stroke and reduce the likelihood of death
3. Reduce the likelihood of dependency post stroke


Evidence on Stroke Rehabilitation

**Patients admitted to an acute and then in-patient rehabilitation stroke unit**

**Strong level 1a evidence of**:
1. reduced rate of death, 2. reduced rate of dependency, 3. decreased hospital length of stay, 4. decreased need for institutionalization, 5. improved functional outcomes.

**Patients admitted to subacute stroke units**

**Strong level 1a evidence** of reduction in mortality and dependency when compared to a general rehab unit.

More on Stroke Specific Rehabilitation

- For mild strokes- no evidence that specialized stroke care makes a difference in outcomes
- For moderately severe strokes- treatment on stroke unit improves functional outcomes but not mortality.
- In severe strokes- treatment on a stroke unit does reduce mortality but does not improve outcomes or need for institutionalization.


Evidence on Predictors for Outcomes

1. Severity
2. Age
3. Balance- A study by Veerbeek in 2011 looked at non-ambulatory patients 72 hours post stroke. Those that had good sitting balance and some hip and knee recovery had increased chance of becoming ambulating independently in 6 months versus those who could not. Many other studies point to the importance of trunk control and sitting balance as predictors of good outcomes.
Evidence on Interventions

1. Therapeutic Exercise
2. NDT and PNF
3. Task Specific Training
4. Orthosis
5. Other beneficial activity

1. Therapeutic Exercise

Cardiovascular training

- Multiple health and government organizations are now recommending cardiovascular training for stroke patients to prevent secondary complications and to improve overall function
- Several RCTs have shown positive outcomes in VO2 peak aerobic capacity, walking speed and endurance
- 1 RCT found improvement in balance
- No direct correlation with improvement in ADL or functional outcomes have been shown (Teasell et al 2013)
Therapeutic Exercise

Strength training
Mixed outcomes, some showed positive and some showed no long term benefits related to basic resistance training (Teasell et al 2013).

Balance training
Stroke is the leading risk factor for falls in older adults, 6x more likely to fall. Improved balance has been shown to be a strong predictor of increased distance walked post-stroke (Pohl, Perera, Duncan et al 2004).

Strong level 1a evidence that balance training improves functional outcomes post-stroke. In particular, improved sitting balance shows a high correlation to improved outcomes (Veerbeek, Wegen, Wel 2011, Teasell et al 2013).

Bridging Evidence into Practice

1. Cardiovascular
   I. Seated for more involved patients
   II. Best with UE use, but only if no sublux and some pain-free AROM at shoulder and elbow. May need assistance with grip.
   III. Treadmill and cross training for less involved

2. Strength
   I. Maintain ankle ROM for improved transfers
   II. Trunk ROM and strength for postural alignment, balance and mobility. Eg. Push/pull, resistance in all directions
   III. Hip extension and knee flex ROM and strength
Bridging Evidence into Practice

3. **Balance**
   
   I. Assess and address somatosensory, visual and vestibular components then increase difficulty by adding cognitive and dual task activity.

   II. *Modified Clinical Test for Sensory Interactions on Balance (mCTSIB)*

Strength and Balance training

- Sitting balance/core/UE wt bearing
- Trunk mobility & strength
2. NDT and PNF

- NDT is most widely studied and compared of all restorative treatments with a good number of RCTs.
- A few studies point to the short term effects on improvement in movement quality.
- **Strong level 1a** that Bobath (NDT) is not more effective than other restorative treatment approaches such as PNF and Motor Learning protocols (Teasell et al. 2013).
- **Conflicting level 4** evidence that Motor Learning Approach is better than NDT but moderate **level 1b** evidence that Motor Learning approach reduces LOS compared with NDT (Langhammer et al. 2000).
- PNF ??? evidence is limited and inconclusive.

2. NDT and PNF bridging the evidence

- Evidence that it is not superior, but not that it is ineffective.
- Neuro-facilitation and re-education techniques are important in normalizing movement to improve efficiency and function.
- Use them to improve movement within a functional training task.
- Use them to equalize weight bearing and body symmetry.
- If you are not trained, don’t worry!!
3. Task Specific Training

There is longer lasting cortical reorganization in stroke patients when they are involved in task specific activities (Teasell, Hussein 2013).

- **Strong level 1a evidence** that task specific gait training can improve gait in stroke patients
- Shown in multiple studies to improve gait speed and endurance
- Practice what is meaningful for the patient. If they need to learn how to walk we have to walk with them as much as possible. Use the existing motor plan to improve function.

Task Specific Training

Review of 7 RCTs performed by English et al looked at task specific training in a circuit training set-up.

All the studies showed positive outcomes for balance, gait speed and ambulation distance, despite great variation in length of session and time post-stroke (English, Hillier 2011).
Task Specific Training

**Treadmill training without PBWS**
- Limited evidence that treadmill training without PBWS is more effective than standard gait training.
- However, studies looking at the cardiovascular and endurance aspect show positive results (Macko et al 2005, Langhammer et al 2012, Teasell et al 2013).

**Treadmill training with PBWS**
- Mixed results that there is significantly greater benefit. In a review of 7 studies with good PEDro score and good sample size. Three showed positive results and 4 showed no significant difference (Teasell et al 2013).
- LEAPS trial (480 participants). Multi centre RCT in phase 3, showed no difference in gait speed, ADLs, social participation between the 3 groups (early PBWS, late PBWS, HEP) at 1 year out (Duncan et al 2011).
- More recent studies are pointing towards positive results.

Task specific training and intensity

- According to animal neuroplasticity studies it takes 400-600 repetitions of a task to cause permanent change (Kimberley et al 2010).
- Studies have been performed where intensity focus was on number of repetitions for a specific task not length of session. Three RCT studies looked specifically at sit to stand training performed in addition to traditional therapy. Sessions varied from 15 to 45 mins.
- Results showed positive effects on weight bearing through affected limb, increased independence and balance during sit to stand transfers (Barreca et al 2004; Britton et al; Tung et al 2010).
Bridging Evidence into Practice

1. Perform gait and transfer training in a meaningful way with high repetitions and increased intensity.

2. Intensity can be addressed by increasing speed over distance which can be used in goal setting. Resisted sit to stands or ambulation.

3. Use treadmill training without PBWS for cardiovascular benefits, increasing repetitions and intensity. Use PBWS in gait training for step length, cadence, weight shift and weight bearing for less involved patients.

4. Treadmill training with PBWS allows for early mobility of more involved patients and increased task specific practice. Generally at 20-40% BWS in most studies. Speed should be as close as possible to normal walking speed, 2-3x/week, for 15-20 mins (http://guideline.gov).

5. If the parallel bars are too restrictive use a hallrail/railing for improved facilitation and handling. Great for Pusher Syndrome and ataxia.

6. Use lift equipment and body weight harness to assist with safety and initial standing to initiate practice earlier.
Evidence on Orthoses

**Traditional AFO**
Strong evidence that AFO’s improve hemiplegic gait pattern but limited evidence that they improve the parameters of gait (Teasell et al 2013).

**FES type orthoses**
Strong evidence that FES in conjunction with traditional gait training improves hemiplegic gait by improving DF during swing phase of gait. Research shows direct benefit to improvement of gait speed.
Bridging the Evidence on Orthoses

**Traditional AFOs**

- Keep supply of plastic and carbon-fiber off-the-shelf AFOs to trial with patients to improve stability and confidence during gait training.
- Allows for earlier mobility and repetitive practice of appropriate gait patterns.

Bridging the Evidence with Orthoses

FES shows good carry-over.

Start with a traditional FES even in acute rehab.

Begin with functional pre-gait activities then progress to using a heel switch during gait training.
FES Orthosis

**Walkaide**-activated by inclinometer and can be used without shoes

**Bioness L300**- foot switch and sensor attached to shoes. Plus model includes thigh cuff for hamstrings

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Other Beneficial Interventions

- **mCIMT**
- **Mirror Therapy**
- **Mental Imagery**

- Extensive research on mCIMT showing positive results.
- Some positive results in research and in practice for others, but require little one on one time.
What to do when you get back to the clinic?

References


References


