Disability after Stroke

- 300,000 – 400,000 Stroke survivors annually
- Leading cause of permanent disability
- 50% : hemiparesis
- 30% : walk with some assistance
- 26% : dependent in ADLs
- 19% : Aphasia
- 35% : depression
- 26% : Nursing Home
Infarct location

- Strokes in insular region (MCA): increased mortality, autonomic dysregulation, early expansion
- Anterior choroidal artery infarctions: progress early
- Internal capsule: worst prognosis for recovery of hand motor function at 1 yr
- Lacunar infarcts, cryptogenic strokes: better prog
- Cardioembolic, large artery: worse prognosis

Predictors of outcomes

- Early neuro deterioration
- Extension of infarct, hemorrhagic conversion
- Progressive edema, raised ICP
- Seizures
- Delirium
- Depression 70-80%
- Integrity of ipsilesional CSP tract: motor recovery (MEP by TCM, DW MRI, DTI)
Risk factors for Disability

- Global aphasia, severe neglect
- Severe stroke, min motor recovery at 4 wks
- Sensory, visual deficits
- Incontinence > 2 weeks
- Decreased level of consciousness
- DM, cardiac disease, comorbidities
- Previous disability
- Old age
- Delay in Stroke Rehabilitation

Stroke Recovery

- Affected: Arm > Leg, Recovery: Leg > Arm
- Proximal > distal
- Tone > voluntary movement
- Most recovery within 3 months
- Early, intensive rehab: A Very Early Rehabilitation Trial after stroke (AVERT): Phase III, multicenter, RCT
- 80% recovery in first year
- Flexor synergy pattern UE, Extensor in LE
Stroke patients: more likely to survive, return home and regain independence if they received organized inpatient stroke rehab unit care

- Fewer medical complications.
- Primary ICH: more severe neurologic impairment and higher mortality in the acute phase
- ICH have better recovery compared to patients with ischemic strokes.

### Stroke rehab

**Goals:**
- Optimize med mgt
- Maximize functional recovery
- Minimize disability
- Improve QOL, participation in society
- Patient centered, comprehensive care

**Rehab team:**
- Physician
- PT, OT, ST
- Nurses
- Psychologist
- Dietician
- Case manager
- Social worker
- Rec Therapist
- Chaplain
Strongest Predictors of outcome: Stroke Severity, Age

- Large strokes, severe clinical deficits
- Age: > 65
- NIHSS score within 24 h of acute ischemic stroke onset:
  - <6 : good recovery (able to live I, return to work)
  - 7-10 : 46% at 3m
  - 11-15 : 23% at 3m
  - >16 : high probability of death, severe disability

Predictors of Motor Recovery

- Severity of arm weakness at onset
- Complete arm paralysis: poor recovery of useful hand function 9%
- No grip strength at 4 weeks
- Severe proximal spasticity, prolonged flaccidity
- Some motor recovery of hand by 4 weeks: 70% chance of making full or good recovery
- Hemianopsia > 3 weeks
- IV tPA: Significant motor outcomes at 3 months
- Mechanical Thrombectomy: superior
• 3 hrs of therapy per day: PT, OT, ST
• Medical acuity
• Daily Physician rounding
• Assistive devices, Wheelchair eval
• Home eval, modifications, CGT
• Outpatient follow up
• Return to work, driving
• Disability
• Driving eval

Acute Inpatient Rehab

• Incidence 25-33%
• Mild
• 300 pts with Aphasia at adm; time to max language recovery in 95% pts with mild, mod, sev aphasia was 2,6,10 wks
• 12-18% at 6 months
• Recovery slower, lasts longer
• Variable
• Depends on size of the lesion
• May occur beyond 1 year (Skilbeck)

Aphasia: Recovery, prognosis
• **Acute Inpatient Rehab**: 3h/day of Therapies
  • Subacute Nursing (or Rehab) Facility – SNF: 1.5h/day
  • LTAC (Long Term Acute Care Hospitals)
  • Nursing Home

**Acute, SNF, LTAC, NH**

• 50% early after stroke
• Aspiration risk
• PEG: high NIHSS score, bihemispheric infarcts
• Retrospective cohort study of 563 pts adm to stroke rehab: FT placed in 30% removed before discharge from rehab; rest by 1 yr

**Dysphagia**
Sensory loss

- 65-94% stroke survivors
- Reduced mobility, ADLs
- Thalamic stroke
- Debilitating post stroke pain syndrome
- Visuospatial neglect: 70-80% recover in 3m
- Hemianopsia: driving

Post CVA

- Medical issues
- Bladder - 50% at 1 week, 15% at 6 months
- Nutrition, Hydration, skin
- Aphasia, Dysphagia
- DVT, PE
- Pneumonia
- Seizures
• **Shoulder pain 72%**
  • RTC tendonitis, Adhesive capsulitis: Intra articular inj, Supra scapular nerve block
  • Brachial plexopathy
  • Subluxation: modalities, Estim, avoid slings
  • CRPS I (RSD, shoulder-hand syndrome): steroids
  • Muscle Spasticity: PO muscle relaxants, Neurotoxin inj (botox, dysport, xeomin)
  • Fatigue 30-70%
  • Depression 40-75%

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**Post Stroke, Outpt**

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- Organic: catecholamine depletion through damage to frontal (NA, DA, 5HT) projections
- Reactive: Grief, psychological responses for physical, personal loss of control, severe disability
- Similar in caregivers (Flick 1999)
- 6 months - 2 years
- Left frontal lesions (controversial)

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**Depression 40%- 80%**

Effects of fluoxetine on functional outcomes after acute stroke (FOCUS): RCT, Lancet 2019
Fluoxetine 20 mg given daily x 6 months after acute stroke does not seem to improve functional outcomes; reduced occurrence of depression, increased frequency of bone fractures.

Depression 40-80%

1. Cortical reorganization:
   • Collateral sprouting
   • Neuroplasticity: Repair, reconnect, recruit neuronal pathways; transform, renew and rewire, stimulated by PT, OT, ST
2. Unmasking of contralateral, ipsilateral pathways
3. Compensation

Stroke recovery
• Therapies within 24 hours
• Intensity of Therapies
• Higher functional gains > 3 hours Therapy
• Organized inpatient stroke unit more likely to be alive, indep, living at home 1 year post stroke
• Encourage therapeutic value of non supervised activity to complement structured therapy
• Delay in Rehab: poor functional outcomes

**Stroke recovery**

**PT**

• Walking speed predicts level of disability.
• Walking speed > 0.8 m/s: full mobility in community
• < 0.4 m/s limited to home
• 0.4 to 0.8 m/s short walks in community
• Improving functional walking capacity is primary goal of PT interventions
• Higher intensity and repetition lead to increased outcomes (Langhorne, French 2009, Moore 2010)
• Number of repetitions of Lower extremity exercises predict time to independent walking and speed (Scrivener 2012)
• Current: Avg 357 steps, 75 active LEx exercises (Lang 2009)
• 2500-4000 steps possible (Moore 2010, Holleran 2013)

How to increase Steps in gait training

• Best way to promote functional recovery after Stroke
• Focuses on practice of skilled motor performance to facilitate neural reorganization, "rewiring" in CNS.
• Patient centered goals, focus to acquire skills
• Repetition is the key
• CIMT: Effect of Constraint Induced Movement Therapy on upper extremity function 3 to 9 months after stroke: EXCITE RCT (JAMA 2006)
• Current: Average 32 functional reaches, 54 active Upper extremity exercises (Lang 2009)
• 300 possible (Birkmannier 2010)

Task Oriented Treatment (TOT)
10/21/2019

60 patients with left or right MCA infarct assigned randomly to music, language, control group x 2months
- listened daily to self selected music or audio books
- Control group- none
- Music group- significantly improved verbal memory, focused attention, less depressed and confused
- Dr Oliver Sachs

**Music:** early post stroke enhanced cognitive recovery, mood

- Compared 2 different therapeutic exercise programs provided by PT to improve ability to walk after stroke
- Task-specific walking program, stepping on treadmill with PBWS
- Exercise program targeted gait-relevant impairments after stroke: weakness and poor balance.
- Stroke survivors in community with marked limitations in walking, task-specific treadmill training with BWS (locomotor training) was not shown to be superior in improving the functional level of walking to home administered PT focused on less-intensive but progressive strength and balance training.

**Locomotor Experience Applied Post Stroke (LEAPS) Trial: Duncan et al, NEJM 2011**
• Virtual Reality
• Vagus nerve stimulator, Implanted
• Robotic exoskeleton
• Wearable devices with sensors: gait, balance

Future