Rehabilitation

What is new…
And no so new?

Basic Principles

• Strokes are increasing
• First wave of baby boomers are now 60 years old and stroke is a disease of older people
• Primary prevention is expensive and difficult

Basic Principles

• t-PA treats up to 10% of strokes and benefits about 1 in 5 (significant impact in up to 2% of all strokes)
• Demand for stroke care and rehabilitation is going to increase as population ages

What does rehabilitation do?

Plasticity
What is it?

When?

Earlier or later?
Basic Principles

- **Benefit of Early Therapy in Animals**
  - Biernaskie et al. (2004) subjected rats to rehab x 5 weeks beginning at 5, 14 and 30 days post small strokes
  - Control animals
  - Social housing (no rehab)
  - Day 5 admission marked improvement, day 14 moderate improvement and day 30 no improvement vs. controls
  - Corresponding cortical reorganization in brain around stroke

Basic Principles

- Strong correlation between early admission to rehab and improved functional outcomes may not be cause and effect
- Severe strokes with higher levels of impairment and higher risk of medical complications, may have their rehab delayed AVERT Trial (Bernhardt et al. 2008 and Cumming et al. 2011)
  - Pts within 24 hrs of stroke onset were randomly assigned to receive standard care (SC) or SC + very early mobilization (VEM) until discharge or 14 days
  - Pts in the early mobilization group returned to walking significantly sooner, were more likely to be independent based on the BI at 3 months or have a good outcome on Rivermead Motor Assessment Scale at both 3 and 12 months.
  - Stroke 2008; 39:390-396
  - Stroke 2011; 42(1):153-8

Basic Principles

- **INTENSITY**
  - Post-stroke rehab increases motor brain reorganization, while lack of rehab reduces reorganization
  - More intensive motor training in animals further increases brain reorganization
  - As a rule, the greater the intensity of therapies clinically, the better the outcomes

Basic Principles

- **INTENSITY**
  - Seen for physiotherapy, occupational therapy, aphasia therapy, treadmill training and upper extremity function in selected patients (i.e. CIMT)
  - One exception is the VECTORS trial (Dromerick et al. 2009) showed high intensity U/E CIMT (6 hrs/day) at day 10 post stroke showed less improvement at 3 mos than less intense Rx
  - Appears it may be a “J”-shaped curve
Basic Principles

- RCT of 146 strokes patients to stroke unit (SU) or gen med (GM) unit
- Median Barthel Index = 4/20 initially in both
- Stroke Unit - BI = 15 after 6 wks; discharged at 6 wks
- General Medical Unit - BI = 15 after 12 wks; discharged at 20 wks

Basic Principles

- Comparison of 4 European Rehabilitation Centers
- Gross motor and functional recovery was better in Swiss and German than UK center with Belgian center in middle
- Differences in therapy time not attributed to differences in patient/staff ratio (similar staffing)
- In German and Swiss centers, the rehabilitation programs were strictly timed while in UK and Belgian centers they were organized on a more ad hoc basis
Basic Principles

- **Task-Specific Training**
  - Best way to relearn a given task is to train specifically for that task
  - In animals, functional reorganization is greater for tasks which are meaningful to the animal
  - Clinically, repetition of motor skills plays an important role in inducing and maintaining brain changes
  - However, less intense (e.g., 30-45 mins.), task-specific training regimens with most affected limb produces cortical reorganization and associated meaningful functional improvements
  - Technology is beginning to play an increasing role

- **CIMT designed to overcome “learned non-use” by restraining unaffected arm while training the affected arm**
  - Intensive task-specific therapy but few trials have similar intensity controls
  - EXCITE trial only 48.8% of control participants received any clinical intervention (Wolf et al. 2006)

  1 JAMA. 2006;296(17):2095-104.
  3 Stroke 2008. 39;1520-25

Walking Recovery Post Stroke

- **CIMT**
  - VECTORS (Dromerick et al. 2009) the mCIMT group and the matched intensity therapy control group did just as well
  - Gauthier et al. (2008) noted some improvements in motor function with dramatically better changes on MRI when compared to similar intensity control
  - Is the key to CIMT the intensity of the therapy or is it the focus on task specificity?

  1 JAMA. 2006;296(17):2095-104.
  3 Stroke 2008. 39;1520-25

Walking Recovery Post Stroke

- Stroke mortality is decreasing and is the 4th leading cause of death
- The leading cause of acquired disability in the adult
  - 2/3ths will have ambulatory dysfunction
Walking Recovery Post Stroke

Why the importance of walking?

Walking Speed Predicts Levels of Function and Survival

- Community mobility requires walking speed > 0.8 m/s (.8 m/sec = 1.8 mph)
- Short community walks are feasible at 0.4 - 0.8 m/s (.4 m/sec = .9 mph)
- Walking is limited to the home at < 0.4 m/s
- Walking speed is associated with survival in older adults

Walking Recovery Post Stroke

- Problem: FALLS
  - > 50% unable to walk at hospital discharge
  - Impaired ambulation → increases the risk for
    - Future falls and fall injuries
    - Hospital readmission
    - A key indications for SNF placement
  - Decrease cardiovascular function → deconditioning (a downward spiral)
  - Limited social participation

Walking Recovery Post Stroke

- Pouwels et al. Stroke. 2009
  - 2 fold increase in risk for hip fracture
  - Highest risk within 3 months of stroke
  - Mortality is increased by almost 50%
  - Need to implement fall risk management in transitional and in community programs

Walking Recovery Post Stroke

- Can we improve walking via rehabilitation?

- YES

Walking Recovery Post Stroke

- A Randomized Trial of Therapeutic Exercise in Sub-Acute Stroke
  - Duncan et al: Stroke 2003
  - To determine the effect of a reproducible, physiologically based, progressive exercise program on strength, balance, endurance, and upper extremity function after stroke.
Walking Recovery Post Stroke

• A Randomized Trial of Therapeutic Exercise in Sub-Acute Stroke
  – Control group received usual care
  – Treated group received
    • Protocol based structure with defined progression for each component
    • Therapist supervised, in-home exercise program
    • Frequency: 3 times/week for minimum of 32 visits or 12 weeks
    • Session duration: 90 minutes

Walking Recovery Post Stroke

• Flexibility
• Strengthening
  – PNF
  – Theraband
  – Functional Activities
• Balance
  – Sitting
  – Standing—Static & Dynamic
  – Gait Challenge
• Endurance—Stationary Bike

Walking Recovery Post Stroke

<table>
<thead>
<tr>
<th>10 meter gait Velocity</th>
<th>Baseline to 3-month change Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>0.18 m/s (0.03)</td>
</tr>
<tr>
<td>Control</td>
<td>0.11 m/s (0.02)</td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

<table>
<thead>
<tr>
<th>Berg Balance Scale</th>
<th>Baseline to 3-month change Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>4.36 (0.71)</td>
</tr>
<tr>
<td>Control</td>
<td>6.00 (1.19)</td>
</tr>
<tr>
<td>Low</td>
<td>2.58 (0.57)</td>
</tr>
<tr>
<td>High</td>
<td>1.70 (0.52)</td>
</tr>
<tr>
<td>Control</td>
<td>2.21 (0.96)</td>
</tr>
<tr>
<td>Session duration</td>
<td>1.23 (0.47)</td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

• Functional Improvement in Post-Acute Stroke: The Importance of Task-Specific Practice, Repetition and Progression
  Rose et al
  – Repetition and intensity matters

Walking Recovery Post Stroke

<table>
<thead>
<tr>
<th>Peak VO2</th>
<th>Baseline to 3-month change Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>1.05 ml/kg/min (0.23)</td>
</tr>
<tr>
<td>Control</td>
<td>0.06 (0.23)</td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

<table>
<thead>
<tr>
<th>Duration of exercise</th>
<th>Baseline to 3-month change Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>1.39 min (0.23)</td>
</tr>
<tr>
<td>Control</td>
<td>0.16 min (0.20)</td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

<table>
<thead>
<tr>
<th>6-minute walk</th>
<th>Baseline to 3-month change Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>61.61 m (9.97)</td>
</tr>
<tr>
<td>Control</td>
<td>33.59 m (7.33)</td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

% of Day engaged in Therapeutic Activity

<table>
<thead>
<tr>
<th>Repetitions per session</th>
<th>% of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>UE Functional Task Practice</td>
<td>32</td>
</tr>
<tr>
<td>UE</td>
<td>357</td>
</tr>
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Walking Recovery Post Stroke

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</table>
Walking Recovery Post Stroke

- **Circuit Training**
  - Involves a tailored intervention program
  - Ability level is continuously monitored, activities are systematically progressed and documented
  - Intervention targeted at multiple domains, i.e. balance and mobility and walking

Walking Recovery Post Stroke

- **Specific Aims**
  - **Aim 1:** To determine the feasibility of implementing a circuit training model
  - **Aim 2a:** To evaluate the effectiveness of a circuit training-based program of intense task-specific practice on balance, gait, sensorimotor recovery and the ability to return home at discharge
  - **Aim 2b:** To evaluate the effectiveness of a circuit training-based program of intense task-specific practice on perceived functional status at 90 days post-stroke.

Walking Recovery Post Stroke

- **Standard Physical Therapy**
  - Therapists set goals, developed a treatment plan and conducted interventions as was customary
  - Time in therapy/day:
    - 60 minute session
    - 30 minute session

Walking Recovery Post Stroke

- **Circuit Training**
  - Circuit Training initiated specific to severity level
  - Rotation through 4 “stations”, 12-13 minutes/station
  - Progression through each station
  - Documentation of exercise level and # of repetitions/level
  - Goal of continuous activity to address cardiovascular system
  - Time in therapy/day:
    - 60 minute circuit training session
    - 30 minute session (WC, orthotic prescription, caregiver training/education)

Walking Recovery Post Stroke

**Determination of Stroke Severity**

<table>
<thead>
<tr>
<th>Severity Level</th>
<th>5 m gait velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>non-ambulatory</td>
<td>---</td>
</tr>
<tr>
<td>severe</td>
<td>(\leq 0.2 \text{ m/s} ) ((\leq 0.45 \text{ mph}))</td>
</tr>
<tr>
<td>moderate</td>
<td>(0.2 \leq 0.4 \text{ m/s})</td>
</tr>
<tr>
<td>mild</td>
<td>(&gt; 0.4 \text{ m/s} ) ((&gt; 0.89 \text{ mph}))</td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

**Circuit Training Circuits by Severity**

- **Non-ambulatory**
  - Rolling
  - Sitting
- **Severe**
  - Dynamic walking
  - Standing balance
- **Moderate**
  - Walking
  - Standing balance
- **High**
  - Walking
  - Standing balance

Walking Recovery Post Stroke

**Circuit Training**

- Rolling
- Sitting
- Stair climbing
- Stretches
- Mobility
- Balance
- Fine motor skills
- Transfers
- Endurance
- Daily living

Walking Recovery Post Stroke

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Walking Recovery Post Stroke

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Walking Recovery Post Stroke

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RESULTS

Specific Aim #1: Is Delivery of a CTPT Model of Care Feasible in Acute Stroke Rehabilitation?

• 97% (72/74) were able to fully participate in CTPT mode of delivery
  – 4, 12-13 minute functional mobility stations in 60 minutes

• No Adverse Events

RESULTS

Specific Aim #2a: Is CTPT more effective than SPT in restoring gait, balance and sensorimotor recovery and in preparation for discharge to home?
Conclusion:
- Individuals 10 days post-stroke can tolerate intense, progressive functional task practice delivered in a circuit training model. Implementation of this type of model of care is feasible.
- Therapy delivered in a circuit training model that emphasized repetition and progression of functional tasks produced greater improvements in gait speed and balance than standard physical therapy delivery.
- The functional advantage to a circuit-training model of therapy observed at time of discharge, was not evident in self-reported functional status at 90 days post-stroke, believed due to no carry over to a home-based exercise program.

Community Wellness Programs
- After discharge from formal rehabilitation, walking deficits remain so availability of accessible community-based wellness programs are essential.
- There exists a current need for these to be established internationally.
- Example:
  - EMPOLI - Community of PHYSIOTHERAPISTS AND COMMUNITY PROGRAM

Empoli Italy
- Geriatrician, (Empoli Health District) - Manages Community Based Programs and Rehabilitation
- Develop Best Practice Models with His Rehab Provider
- Established Community Based Programs
- Established clinically relevant data bases - Measured the Outcomes
- Support of Italian Health Ministry
Walking Recovery Post Stroke

Body Weight Supported Treadmill Training
Walking Recovery Post Stroke

- Body Weight Supported Treadmill Training
  - An emerging modality to improve walking but…
- Limited evidence to support its value
- Cochrane Review 2002 & Cochrane Review 2005
  - Lack of practice guidelines
  - Appropriate dosing and timing of interventions after stroke is unknown
  - Growing consensus in clinical practice
  - Growing commercial market
  - Repetitive and progressive practice of stepping using supported treadmill systems is effective

Walking Recovery Post Stroke

LEAPS was designed to determine:
- If a walking training program that includes BWST (LTP) is superior to a home physical therapy program
- If the timing of intervention delivery for LTP (Early (2 months) vs. Late (6 months) after stroke) effected recovery.
- If initial walking impairment severity (Moderate vs. Severe) effected response to the interventions.
- What dosing (12, 24, or 36 sessions) is required.

Walking Recovery Post Stroke

Interventions

- 30-30 min at 2 mph on TM with BWSS
  - Progression; endurance, speed (SWR), independence, adaptability
  - Followed by walking practice off the treadmill
  - 1:1 therapist/patient

- Strength exercises
  - Balance exercises
  - Progression; repetitions, activity, balance challenges, resistance
  - Encouragement to walk daily
  - 1:1 therapist/patient

Walking Recovery Post Stroke

Primary Inclusion / Exclusion Criteria

Inclusion
- Age ≥ 18 years
- Stroke within 45 days and living in the community at 2 months post-stroke
- Residual paresis in the lower extremity
- Ability to walk 10 feet with no more than 1-person assistance
- Self-selected 10 meter walking speed less than 0.8 m/s
- Physician approval for participation
- Successfully pass an exercise tolerance test

Exclusion
- Dependent in ADLs prior to stroke
- Pre-existing neurological disorders
- Multiple co-morbidities that would be contraindications for exercise programs
- Inability to travel to treatment site
- Walking equal to or faster than 0.8 m/s

Walking Recovery Post Stroke

Baseline at 2 Months Post-stroke

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.1±12.7 mean age</td>
<td>Mean walking speed = 0.38±0.22 m/s</td>
</tr>
<tr>
<td>46.1% Female</td>
<td>53.4% severe impairment (&gt; 0.4 m/s)</td>
</tr>
<tr>
<td>22.1% Black or African American</td>
<td>46.6% moderate impairment (0.4 ± 0.8 m/s)</td>
</tr>
<tr>
<td>83% Ischemic</td>
<td>Median Number of Daily Steps 1738 (708-3483)</td>
</tr>
<tr>
<td>99.5% Modified Rankin 2-4</td>
<td></td>
</tr>
<tr>
<td>63.8 days post-stroke at randomization</td>
<td></td>
</tr>
</tbody>
</table>

Walking Recovery Post Stroke

- Hypothesis 1
- That 1 year after stroke both the LTP-early and LTP-late groups would have a higher proportion of participants who improve functional level of walking than the home exercise group (HEP).
Walking Recovery Post Stroke

Hypothesis 2
That improvements in walking speed from baseline to 1-year after stroke for LTP subjects trained at 2 months will be significantly greater than for subjects trained at 6 months.

Results:
- Early-LTP mean change in comfortable walking speed was 0.23±0.20 m/s
- Late-LTP mean change in comfortable walking speed was 0.24±0.23 m/s
- No significant interaction between baseline severity of walking impairment and timing LTP for walking speed at 1 year

Walking Speed at 6 Months
Six months after stroke, Early-LTP (0.25±0.21 m/s) and HEP (0.23±0.20 m/s) groups had similar gains in walking speed and sustained these gains at 1 year.

The Late-LTP group (which only received usual care from 2 to 6 months) improved by 0.13±0.14 m/s at 6 months.

But
What if compared to usual or standard PT
Walking Recovery Post Stroke

Usual Care (UC) is Highly Variable

• 18% received no physical therapy after 2 months post-stroke
• Median number of visits -11 (0 to 69 visits)
• Approximately 60 minutes per therapy session
• Older participants received fewer therapy sessions

Walking Recovery Post Stroke

Falls and Falls Rate

• The most common minor adverse event was falls
  – 57.6% of individuals experienced 1 fall
  – 34% experienced multiple falls
  – 6% experienced an injurious fall
• More multiple falls in early-LTP group than late-LTP or HEP (p<0.07)
  – Attributable to more multiple fallers in the severe group receiving early-LTP (p< 0.02)

Walking Recovery Post Stroke

Therapy Message

• Suggest that both programs have similar outcomes at 1 year and both are superior to usual care provided according to current standards.
  – Patients recover faster and sustain recovery when the intervention is given early

Walking Recovery Post Stroke

Preplanned Secondary Analysis of 6 Month Outcomes

Late-LTP (usual care) experienced approximately HALF the improvement of early intervention groups

<table>
<thead>
<tr>
<th>Item</th>
<th>LTP (n=97)</th>
<th>HEP (n=53)</th>
<th>UC (n=125)</th>
<th>Overall p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfortable Walking Speed (m)</td>
<td>0.35±0.21</td>
<td>0.33±0.20</td>
<td>0.51±0.14</td>
<td>0.0001</td>
</tr>
<tr>
<td>6 Minute Walking Distance (m)</td>
<td>61.5±22.8</td>
<td>75.9±9.3</td>
<td>61.0±47.4</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
| Step Activity Monitor (SAM) – median of average number of steps/day (25th – 75th percentile) | 19.7±2322 | 1857±3482 | 266±2452 | 0.0767
| Stroke Impact Scale (SIS)        | 11.9±25.7  | 14.0±22.9  | 7.7±20.5   | 0.0364         |
| Participation range (n=0-100)    | 9.6±17.2   | 13.0±15.9  | 7.0±17.8   | 0.0516         |
| Gait Velocity (range = 0-100)    | 15.3±21.4  | 14.2±20.0  | 7.3±16.7   | 0.0006         |
| Knee/Ankle Flexion (range =0-60) | 2.3±3.4    | 2.4±4.1    | 1.3±3.3    | 0.1366         |
| Berg Score (range =0-66)         | 8.9±6.1    | 7.6±8.6    | 6.3±7.0    | 0.0018         |
| Activities Specific Balance (range=0-100) | 13.9±25.5 | 18.6±19.4 | 6.2±20.2   | 0.0013         |

Walking Recovery Post Stroke

Therapy Message

• The patients in the late body-weight supported treadmill program group made significant improvements in walking speed, despite the widely held assumptions and reports that most functional improvements after stroke are complete by six months.
• Patients can recover when therapy is given late!
What else did we learn from LEAPS?

- Falls: 2-12 months
- High incidence (58%)
- Severe impairment:
  - Higher rate of multiple falls
  - Inability to get up after stroke
  - Higher risk with early LTP

• Implications for PT
  - Fall prevention is essential
  - Address early
    - Concomitant Evidence Based Multifactor Risk Management
  - Teach fall recovery

Walking Recovery Post Stroke

Aphasia

- Poor prognostic indicator (Laska et al., 2001; Pedersen et al., 1995)
- Severity influences recovery (Lazar et al., 2010)
- Aphasia is persistent (Lazar et al., 2010)
- Aphasia is debilitating (Kauhanen et al., 2000)

What else did we learn from LEAPS?

- Falls: 2-12 months
- Most falls occur early and at home
  - Berg Balance Score ≤42 a robust indicator of risk
    - Multiple or Injurious falls

• Implications for PT
  - Slower walkers are at higher risk
    - Recognize implications of early mobility and falls
  - Use the Berg to inform care

Aphasia

- Affects 20 to 40% of all stroke patients
- Aphasia
  - Disrupts reading, writing, speaking,
  - Makes it hard to
    - Reading e-mail
    - Writing e-mail
    - Giving a lecture
  - Makes it hard to participate in rehabilitation
Aphasia

- General consensus that aphasia therapy is effective (Robey, 1998; Boghal, 2003; Cappa et al., 2003; Kelly et al., 2010; Cicerone et al., 2011)
  - Treated outcomes superior vs. Untreated
  - More striking for acute stages

Aphasia

- Intensive therapy (2> hrs / week) are better outcomes vs. less intensive therapy over a longer time (usual care) (Robey, 1998; Boghal, 2003; Kelly et al., 2010; NSF., 2010)
  - 2 hrs / week minimum and 5 hrs /week optimal (CPG)
  - But, more dropouts in “intensive” groups
  - Tolerate intensive?

Is one therapy better?

- Type of treatment: positive outcomes for:
  - Functional therapy approaches and verbal expression (naming)
  - Semantic = phonological treatments
  - Constraint induced language treatment (CILT) is promising
  - CILT + everyday communication training > CILT alone
  - Still insufficient evidence to cf Therapy A vs Therapy B (Robey, 1998; Cicerone et al., 2011; Kelly et al., 2010)
  - Both group and 1:1 therapy effective (Kelly et al., 2010)
  - But not enough evidence to determine which is superior

Aphasia

- Volunteers can provide effective therapy (Boghal, 2003; Kelly et al., 2010)
  - Trained and supervised under the direction of a SLP
  - Home exercise program
  - The care giver can also be a therapist/coach

Aphasia

- Pharmacotherapy
  - SLT + drugs acting on cholinesterase inhibitor donepezil and NMDA receptor antagonist memantine = better outcomes than drugs or SLT alone (Berthier et al., 2011)
  - Amphetamines, bromocriptine and antidepressants have been tried with varying degrees of success
Aphasia

- Treatment for people with bilingual aphasia
  - Therapy in L2 = Therapy in L1 and in most studies there was cross language transfer (Farqi-Shah et al., 2010)

- Communication partner training (CPT)
  - CPT improves ability to support a person with aphasia’s conversation
  - CPT is probably effective in improving PWA communication
  - Not enough research to conclude re acute stages, and if language impairment or QOL improve (Simmons Mackie et al., 2010)

Dysarthria

- Dysarthria
  - More commonly with brainstem infarctions
  - Also occurs with hemispheric infarction in particular bilateral hemisphere infarctions

Dysphagia

- Dysphagia
  - Evaluation techniques
  - Bedside
  - Modified barium swallow
  - Fiberoptic Endoscopic Evaluation of Swallow

- At the conclusion of the evaluation, it will be decided if the patient should be:
  - NPO
  - By mouth
Dysphagia

- Dysphagia
  - Treatment options include:
    - N.P.O.
    - By mouth
    - Liquids with or without ticket
    - Food consistency
    - Proper posture

- Dysphagia exercises
  - Mendelsohn maneuver
  - Masako technique
  - Forceful multiple swallowings
  - Neuromuscular Electrical Stimulation
    - VitalStim
  - Deep Pharyngeal Neuromuscular Stimulation
    - Thermal, texture

SSRI’s Role in Rehabilitation

- Spontaneous lesioned brain reorganisation can be modulated through:
  - Rehabilitation procedures
  - Cortical stimulations (TDCS, rTMS…)
  - Peripheral stimulations or inhibitions
  - Stimulation of proprioceptive input
  - Anesthetic block
  - Monoaminergic drugs
  - Amphetamines
  - Antidepressants: SSRI, SNRI, Monoamine oxydase Inhibitors…
  - But also: dopaminergic agents, piracetam, donepezil…

SSRI’s Role in Rehabilitation

- Depression is also a major issue for stroke patients:
  - Prevalence among in-patients
    - 19.3% and 18.5% for major and minor depression respectively (Robinson et al 2003)
  - Prevalence among out-patient studies
    - 23.3% for major depression and 15% for minor depression (Robinson et al 2003)
  - Persistent depression in more than half (55%) of the individuals identified as depressed during inpatient rehabilitation post stroke (Farner et al 2010).
SSRI’s Role in Rehabilitation

- The risk factors associated with increased risk for post-stroke depression (PSD) include
  - Female sex,
  - Past history of depression or psychiatric illness,
  - Functional limitations,
  - Cognitive impairment

- Predictors of persistent depression include
  - Lower levels of pre-stroke social activity,
  - Greater severity of stroke and lower levels of function at baseline

SSRI’s Role in Rehabilitation

1- Does post stroke depression reduce post stroke recovery?
- Mobility decline was experienced between 1 and 3 years post stroke by 21% of participant of a prospective cohort study (n=205) (Van de Port et al. 2006).
- Significant predictors of this decline in mobility status were
  - Level of activity,
  - Cognitive problems,
  - Fatigue
  - Depression

1- Does post stroke depression reduce post stroke recovery? :
- Co-occurrence of stroke and depression is associated with greater physical limitations than either condition on its own (Goodwin and Devanand 2008).

SSRI’s Role in Rehabilitation

Conclusion: Depression post-stroke has a negative impact on functional recovery

SSRI’s Role in Rehabilitation

2- Are Antidepressants active in post stroke depression?
- Interventions for treating depression after stroke (Hackett et al; The Cochrane Database of Systematic Reviews 2010 Issue 1)
  - “Antidepressant drugs may be useful in treating depression after stroke, but also cause side effects….
  - These drugs should be used with caution in people with persistent depressive symptoms after stroke, as little is known about the risks, especially of seizures, falls, and delirium….”
SSRI's Role in Rehabilitation

2- Are Antidepressants active in post stroke depression?
- The following antidepressants have been shown to be effective in post-stroke depression
  - Heterocyclic antidepressants (Robinson et al 2000)
  - SSRI (Hackett et al 2010)
  - SNRI: reboxetine is effective in reducing retarded post-stroke depression (Rampello et al 2005)

SSRI's Role in Rehabilitation

3- Can Antidepressants prevent the occurrence of depression in stroke patients?
- Escitalopram and problem solving therapy for the prevention of stroke (Robinson et al 2008 JAMA)

SSRI's Role in Rehabilitation

4- Antidepressants and Stroke Outcome in Stroke patients with Depression
- Early identification and treatment of post-stroke depression may serve to enhance functional recovery.
- Improvement in depressive symptomatology has been associated with reduced odds for dependency at 3 months post stroke (Schmid et al. 2011)

SSRI's Role in Rehabilitation

This was a negative study
- Showed improved depression BUT no improvement in neurological deficit
SSRI’s Role in Rehabilitation

4- Antidepressants and Stroke Outcome in Stroke patients with Depression:

• Interventions for treating depression after stroke (Hackett et al; The Cochrane Database of Systematic Reviews 2010 Issue 1)
  – This review of 16 trials, including 1655 participants, found that antidepressant drugs may produce recovery or improve depression symptoms.

Despite negative studies, there are arguments to think that pharmacologic treatment of depression is associated with improved functional recovery post-stroke.

Citalopram improves dexterity in the chronic stroke patients

8 patients

Single dose 40 mg citalopram

Cross over

Zittel et al NNR January 24, 2008

Fluoxetine Modulates Motor Performance and Cerebral Activation of Patients Recovering from Stroke

Prospective double-blinded study testing one 20mg single dose of fluoxetine against placebo

8 patients with a pure motor stroke

Subcortical lesions

Capable of doing repetitive flexion-extensions with their finger

Fluoxetine significantly improved motor skills of the affected side

A single dose of fluoxetine was enough to modulate cerebral sensory-motor activation
SSRI's Role in Rehabilitation

- Conclusion:
  - Fluoxetine improves motor function of patients with severe motor deficit when given early after ischemic stroke.
  - Fluoxetine increases the number of independent patients at 90 days.
  - Post stroke brain reorganization target either directly on motor function or indirectly through attention network or both.
  - World public health interest:
    - Fluoxetine in the public domain
    - Well-tolerated drug
    - No need for major technical facilities