Integration of Stroke Patients into a Non-Stroke World

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Objectives

- Briefly Discuss the Current State of Stroke
- Interpret the Rapidly Changing Areas within the Stroke Spectrum
  - Timely Identification and Treatment of Stroke
  - Mechanisms of Stroke Recovery
- Discuss Advances in Rehabilitation of Stroke Patients
- Review Assistive Devices and Adaptive Equipment
- Question and Answer Session
Disclosures

• None
In the United States:

- Stroke is the 3rd leading cause of death
- Leading cause of long-term disability
- ~4 million people living with the effects of stroke
Epidemiology

According to the National Stroke Association

- 10% - Recover almost completely
- 25% - Recover with minor impairments
- 40% - Moderate to severe impairments, need special care
- 10% - Nursing home care or other long-term facility
- 15% - Die shortly after the stroke
- ~14% - 2nd stroke within 1 year
Types of Stroke

- **Ischemic**
  - Sudden loss of blood flow to an area of the brain
  - Corresponding loss of neurologic function
  - Thrombotic or embolic occlusion of a cerebral artery
  - More common than hemorrhagic stroke
Types of Stroke

- Hemorrhagic
  - Bleeding occurs directly into the brain parenchyma
  - Leakage from small intracerebral arteries
  - Chronic hypertension
  - Arteriovenous Malformations

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Factors Affecting Outcome

- Amount of Brain Damage
- Arrival time at ED from onset of deficit
- Support network
- Timing of Rehabilitation
  - Earlier the better
Outcome Improvement Strategies

- Community Education
  - Early recognition of symptoms
  - Modification of NIH stroke scale
    - Early recognition by EMS
- Early notification of ED
- Code stroke teams
- Early ID of patients eligible
  - tPA
  - Thrombolectomy

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Post Stroke Conditions (Physical)

- Dysphagia
- Fatigue
- Hemiparesis
- Foot drop
- Spasticity
- Incontinence
- Pain
- Visual Impairment
- Neglect
- Sleep disturbances
- Epilepsy
Post Stroke Conditions

• Emotional
  • Depression
  • Pseudobulbar affect
    • Uncontrolled laughing
    • Uncontrolled crying
  • Frontal Release syndromes

• Cognitive
  • Memory impairment
  • Vascular Dementia
  • Aphasia
Definition of Rehabilitation

• Process of adaptation or recovery through which an individual suffering from a disabling or functionally limiting condition, whether temporary or irreversible, participates to regain maximal function, independence, and restoration

• Process to restore mental/or physical abilities lost to injuries or disease, in order to function in a normal or near normal way (National Cancer Institute, 2007)
Goals of Rehabilitation

• Enable stroke patients to:
  • Reach the highest possible level of independence
  • Be as productive as possible
  • Improve quality of life
  • Assist caregivers to provide optimum level of care
Effects of Rehabilitation

- Stroke units
  - Provide daily skill training therapies
  - Highly stimulating environments
    - ↓ deficits
    - ↑ performance on self-care tasks
    - ↓ 1-year mortality
    - ↓ probability to be in a nursing home at follow-up

(Teasell, J. et al, 2005)
Effects of Rehabilitation

- Facilitates recovery that might occur spontaneously
  - Functional restoring of damaged nervous tissue
  - Relearning lost skills
    - Reorganization of spared pathways (plasticity)
  - Adaptation
  - Compensation for deficits
    - Alternative behavioral strategies \(\rightarrow\) solve a task
- Learning-dependent process
- Most recovery
  - 3 to 6 months after stroke
  - Improvements can continue for years
Neural Plasticity

• Poststroke recovery
  • Plasticity
    • Ability of CNS cells to modify structure and function
      • In response to external stimuli
  • Balance between
    • Cell-intrinsic mechanisms
    • Extrinsic regulatory molecules

Alessio Faralli, et al, 2013
Neural Plasticity

Plasticity Prevented by:

- Myelin-associated proteins
  - Nogo, MAG, and Omgp
- Astrocyte secreted factors
  - Chondroitin sulfate proteoglycans
- Semaphorins, netrins, ephrin
- These factors
  - Constrain axonal sprouting
  - Hamper formation of new connections

Alessio Faralli, et al, 2013
Neural Plasticity

In preclinical stroke models:

- Induction of axonal sprouting
- Promotion of functional recovery
  - 2° to pharmacological blockade of Nogo
  - Nogo receptor antagonism
  - Digestion of chondroitin sulfate proteoglycans
    - By chondroitinase

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Rehabilitation Team

Inpatient Rehabilitation
- Referring Physicians
- Other Medical Specialists
- Rehabilitation Psychologist & Neuropsychologist
- Rehabilitation Nurses
- Translators: Vocational Counselor (Adults), Hospital Teacher/School Liaison (Children)
- University Resources
- Local & Global Communities

Outpatient Rehabilitation
- Social Worker
- Case Manager
- Therapists: PT, OT, RT, SLP

Patient & Family

Subacute Rehabilitation

Long Term Acute/Care

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Physical Therapy

- Addresses Mobility
  - Bed Mobility
  - Transfer Training
  - Ambulation
- Evaluation for adaptive equipment
  - Canes, Walkers
  - Braces
- Functional Electronic Stimulation
- Neurofacilitation
Occupational Therapy

- Addresses Activities of Daily Living
  - Dressing
  - Bathing
  - Grooming

- Splinting

- Adaptive equipment
  - Reachers, sock aids, built up utensils

- Pre-drivers evaluation
Speech Therapy

- Swallow Evaluation
  - Dietary Recommendations
  - Vital Stimulation
- Cognition Evaluation
- Memory Assessment
- Coping Skills
  - Memory Books
- Communication Evaluation
Neuro-psychology

- Evaluation of cognitive deficits
- Screening for post-stroke depression
- Capacity Evaluation
- Level of Supervision needed at home
- Support and Counseling
  - Patient
  - Family members
Social Worker/Case Management

- Assists with discharge planning
- Provides family and patient
  - Community Resources
  - Coping Skills
- Sets up home health services
  - PT
  - OT
  - ST
  - Nursing
Neuro-optometry

- Visual Rehabilitation
- Visual Retraining
  - Prisms
  - Goggles
  - Brock Quoits and Strings
Rehabilitation Strategies

- Functional Electronic Stimulation
- Mirror Therapy
- Virtual Reality
- Constraint Induced Movement Therapy
Rehabilitation Strategies

Brain Stimulation

- Transcranial Magnetic Stimulation (rTMS)
- Transcranial Direct Current Stimulation (tDCS)

Robot Assisted Rehabilitation
Rehabilitation Strategies

• Mental Imagery

• Music Therapy
  • Melodic Intonation Training

• Vestibular Rehabilitation
Gait aids
- Walkers Standard walker
  - Hemiwalker
  - Rolling walker
  - Rollator (basket, break, seat)
- Canes
  - Single point cane
  - Quad canes
- Scooters
Therapeutic Splinting

- Provided by the therapists
  - Follow appropriate splint schedules
  - Monitor skin
  - Prevents Contracture
  - Assists with Function
  - May provide stability
Home Safety

- Clear paths
  - Kitchen
  - Bedroom
  - Bathroom
- Wear nonskid shoes
- Avoid slick surfaces
- Remove loose carpets
- Fasten runners
  - Hallways and stairwells
- Install handrails
  - Support on stairs
Home Safety / Adaptive Equipment

- Install assistive/safety devices
  - Raised toilet seat
  - Tub bench
  - Handled shower head
  - Plastic strips
    - Adhere to the bottom of a tub
  - Long-handled brushes
  - Washing mitts
    - Pockets for soap
  - Electric toothbrushes
  - Electric razors
Lifestyle Modifications

- Do not rely furniture for support
  - Use assistive devices
- Recognize medication effects
  - Drowsiness
  - Taking precautions
- Limiting walking when distracted
- Limit walking without prescribed aids
  - Braces
  - Canes
  - Walkers
Social Support Systems

- Large social support networks
  - Positive influence
    - Recovery
    - Quality of life
- Day service programs
  - Increase participation in leisure activities
- Stroke Survivor Support Groups

Family Support

• While in Rehabilitation hospital
  • Individualized discharge planning
  • Practical skills training
    • May ↓ depression and anxiety
    • Enhance quality of life
      • Caregiver
      • Stroke survivor
    • Improves caregiver preparedness
  • Access to interactive web-based resources
    • May ↓ depression in caregivers

Family Support

• After Discharge
  • Stroke caregivers may experience
    • ↓ Mental health
    • ↓ Social contact and activity
    • ↑ Risk for depression
  • Support received from care-giving peers
    • Shared experience of caring for a stroke survivor
    • Positive effect on caregivers
Leisure Activities/ Adaptive Sports

- Post-stroke deterioration is common
  - Social
  - Leisure activities
- Leisure therapy
  - May result in improved leisure activity
- Improved subjective physical outcomes
  - Participation in group exercise
  - Patient education

Sexuality

- ↓ in sexual activity - common post-stroke
  - Changed body image
  - Reduced self-esteem
  - Lack of communication with one’s partner
- Address sexual issues
  - Part of community reintegration


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Driving

- Pre-driving evaluation
  - Occupational therapy eval
- Visual attention / Visuoperception retraining
- Use of a simulator training program

Return to work

- Evaluate potential to return to work
- Vocational rehabilitation strategies
  - Job Retraining
- Return to work - 18 months post stroke
- Factors predictive of return to work
  - Normal muscle strength
  - Absence of apraxia
  - White-collar occupation (tendency to promote return to work)

Work Adaptations

- One-handed keyboards
- Ergonomic office chairs
- Devices
  - Lifting
  - Grasping
  - Reaching
- Communication Aids
- Task Reassignment
National Stroke Support Groups

**American Stroke Association: A Division of American Heart Association**
info@heart.org
http://www.strokeassociation.org
Tel: 1-888-4STROKE (478-7653)

**Brain Aneurysm Foundation**
office@bafound.org
http://www.bafound.org
Tel: 781-826-5556 888-BRAIN02 (272-4602)

**Brain Attack Coalition**
http://www.stroke-atlanta.org
Tel: 301-496-5751

**National Stroke Association**
info@stroke.org
http://www.stroke.org
Tel: 303-649-9299 800-STROKES (787-6537)

**National Aphasia Association**
naa@aphasia.org
http://www.aphasia.org
Tel: 212-267-2814 800-922-4NAA (4622)

**Children's Hemiplegia and Stroke Assocn. (CHASA)**
info437@chasa.org
http://www.chasa.org
Tel: 817-492-4325

**Hazel K. Goddess Fund for Stroke Research in Women**
anne@thegoddessfund.org
http://www.thegoddessfund.org
Tel: 561-623-0504

**Heart Rhythm Foundation**
support@heartrhythmfoundation.org
http://www.heartrhythmfoundation.org
Tel: 202-464-3454

**BrightFocus Foundation**
http://www.brightfocus.org/alzheimers/
Tel: 1- 800-437-2423

**YoungStroke, Inc.**
info@youngstroke.org
http://www.youngstroke.org
Tel: 843-248-9019
References

- Henderson A, Korner-Bitensky N, Levin M, Department of Neurology and Neurosurgery, Faculty of Medicine, McGill University, Montreal, Quebec, Canada. Topics in Stroke Rehabilitation [2007, 14(2):52-61]
- Stroke.org
- EBRSR (Evidence-Based Review of Stroke Rehabilitation) Chapt 19, Community Reintegration Katherine Salter PhD (cand.), Laura Allen MSc (cand.), Marina Richardson MSc, Robert Teasell MD, Norine Foley MSc Last Updated: November 2013
References Cont’d

- http://www.hopkinsmedicine.org/psychiatry/specialty_areas/brain_stimulation/tfca.html
Reference Slides
Functional Electronic Stimulation

- Stimulate the nerves of weakened muscles
  - Muscle contractions → functional tasks
- Significant difference in shoulder subluxation
  - Only if FES was applied early after stroke
- No effects
  - Pain
  - Motor function outcomes

Amir K. Vafadar et al, 2015
Constraint Induced Movement Therapy (CIMT)

- Restriction of usage of the unaffected limb
- Forces the use of the paretic limb
- Prevents learned nonuse
- Limitations to use
  - Labor intensive
  - Only for patients with
    - Conservation of motor functions (wrist/ fingers)

Mental Imagery

• Theory
  • Movement requires activation of brain circuits involved in the preparation and execution of the same movement

• Repetitive cognitive training
  • Patient imagines performing a task or body movement
  • Without actually physically performing task

Mirror Therapy

- Multisensory stimulation

- Mirror placed 90° - patient mid-sagittal plane
  - Paretic limb hidden behind mirror
  - Patient watches the unaffected arm
    - Impression that the affected limb is functioning
  - ↑ the excitability of neurons in the Ipsilateral 1 ° motor cortex

Virtual Reality

- Computer Generated 3D environment
- Provides
  - Repetitive practice
  - Feedback about performance
  - Motivation to endure practice
- Can control exercises for patient rehabilitation
  - Functional
  - Purposeful
  - Motivating context

Brain Stimulation

- Transcranial Magnetic Stimulation
  - (rTMS)

- Transcranial Direct Current Stimulation
  - (tDCS)

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Brain Stimulation

- ↑ excitability of ipsilateral damaged hemisphere
- ↓ the activity of intact surrounding or contralateral area
  - Produces intra- or inter-hemispheric inhibition
- Restore unbalance between intact and lesioned hemispheres
Music Therapy

- Social Effects
  - Reintegrate patients into social relationships
  - Establish relationship between inner rhythms of body and outer rhythms of personal interaction
- Psychological Effects
  - Mood improvement
  - Encouraging self-expression
  - Temporal coherence
  - Disease related stress
- Cognitive Effects
  - Improves
    - Communication
    - Spatial-reasoning
    - Memory
    - Executive functioning
  - Increasing status of arousal
- Physical Effects
  - Sensory stimulation
  - Motor integration
  - Mood-related physiologic response (HR, BP, Renal Perfusion)
  - Decreases pain

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Robot Assisted Rehabilitation

- Administer intense repetitive training
  - Facilitates recovery
- Studies non-conclusive to date
  - Significant effects - motor recovery of the upper limb
  - No significant effect
    - Functional ability
    - Does not improve arm muscle strength
- May improve
  - Generic activities of daily living
  - Paretic arm function
Vestibular Rehabilitation

- Exercise-based program
  - Promotes CNS compensation
  - More useful for inner ear deficits
- Treats a variety of vestibular problems
- Often tried post stroke (cerebellar)
  - Due to severity of patient symptoms