Pediatric Stroke and Constraint-Induced Movement Therapy (CIMT)

Presented by:
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PICO Question

• Is constraint-induced movement therapy (CIMT) more effective than traditional physical therapy interventions for increasing upper extremity function on the hemiparetic side of the body in patients with pediatric stroke?
Patient Profile

• Presentation
  – Age dependent
  – Variable

• Signs/Symptoms
  – Headache
  – Fever
  – Seizures

• Pediatrics
  – Most common cause of perinatal brain injury and CP

• Impairments/function al limitations
  – Hemiparesis
Pathophysiology

• **Arteriopathy of cerebral arteries (>50%)**
  – Sickle Cell disease
  – Moyamoya
  – Transient cerebral arteriopathy of childhood
  – Post-Varicella angiopathy
  – Bacterial meningitis vasculitis
  – Isolated angiitis of CNS
  – Systemic vasculitides
Pathophysiology cont.

• Complex Congenital Cardiac Disease
  – Cardiomyopathies
  – Arrythmias
  – Endocarditis

• Prothrombotic disorders (20-50%)
Diagnosis

• Clinical Presentation
  – Retrospective diagnosis

• Radiographic Diagnosis
  – MRI
  – CT
Interventions for Pediatric Stroke

- Constraint-Induced Movement Therapy (CIMT)
- Transcranial Magnetic Stimulation (TMS)
- Electrical Stimulation (ES)
- Spasticity Intervention - Tone
- Pharmacological
- Assistive Devices
Methods

• Database search
  – EBSCOhost
  – PUBMed
    • Terms: Pediatrics, Stroke, Hemiparesis, Constraint-Induced Movement Therapy, Interventions, Physical Therapy
    • Numbers: 13
Research Synthesized

• Systematic Review: 4
• Case Report: 1
CIMT

- Based on science of behavioral “learned non-use” and neuroscience of plasticity

http://www.russo4camphigh5.org/CIMT.htm
What is constraint-induced movement therapy?

3 main components

1. Intensive Practice
   - Shaping

2. Prolonged Restraint
   - Promotion of use of involved extremity

3. Transfer Package
   - Encourage use of functional gains made in therapy to daily tasks
Background Information

• **Adult Stroke Use**
  – The adult CNS retains the ability to compensate for injury and reestablish functional motor patterns throughout the lifespan\(^5\)
    • ~ 200 reports of successful CIMT with adults have been published
    • Study of 400 adults with chronic stroke
Background Information

• Emerging applications to pediatric stroke population

• Why we think this will benefit pediatric stroke patients?
  – Greater neuroplasticity of the immature nervous system
Background Information

• Pediatric Cerebral Palsy
  – CIMT
    • Increase in emergence of new motor patterns and UE skills$^5$
  – Benefits maintained CIMT
    • Retention of 70% to no loss$^5$
CIMT in Pediatrics

- Attention span of children vs. adults
- Shaping activities carried out by therapeutic play
- Feedback is immediate\(^5\)
  - Smiles, gestures, applause, expressions of approval
CIMT in Pediatrics

- Children over 8
  - Can use adult model

- Therapeutic tasks
  - Selected based upon:
    - Family and child’s goals
    - Motivating factors for the child
    - Promotion of independence and age appropriate activity
    - Movements that PT believes have the greatest potential for improvement

Physical Therapy Involvement

- Family Education
  - Possibility of frustration especially with initial stages of casting.²
  - Family preparation for treatment challenges

http://pixgood.com/pediatric-cimt.html
Physical Therapy Involvement

• Safety considerations²
  – Protective response of casted limb? (e.g. catching self from a fall)
  – Increased risk of getting hurt from a fall, spilling things or knocking things over
  – No operation of bicycle, tricycle or use of sharp objects
Results

• Child-friendly modifications to CIMT
• RCT of CIMT in 20 children hemiparesis secondary to prenatal/neonatal stroke\textsuperscript{5}
  – Protocol similar to adult's
  – Children exhibited more new classes of motor skills
    – ES=2.05
  – Significant gains in spontaneous use of hemiparetic limb at home – ES=7.3
  – Retention of gains over 6 months – 70-100%
Discussion

- CIMT can dramatically improve the motor function of the involved UE in children with hemiplegia\(^5\)
  - Gains in children significantly greater than those of adults

- High levels of parent/child satisfaction with treatment outcomes\(^2,5\)
Discussion cont.

- Best candidates for pediatric CIMT:
  - Ability to use hemiparetic limb to assist$^2$
PICO Question Revisited

• CIMT is an effective intervention to increase upper extremity function.
  – No information stating whether it is better than existing therapy options
Areas for Future Research

• RCT’s looking at CIMT vs. traditional physical therapy in pediatrics

• Looking into the role of motivation to move on CIMT
  – Level of cognition and its effect on treatment outcome
References