Stepping Into Physical Therapy Management for Individuals with Cerebral Palsy following Single Event Multi-Level Surgery

Kelly Greve, PT, DPT, PCS
Michelle Menner, PT, DPT, CBIS

Disclosure Information

Kelly Greve, PT, DPT, PCS
Michelle Menner, PT, DPT, CBIS

We have no financial relationships to disclose
Evidence-Based Practice Team Members

Caroline Colvin, PT, DPT, PCS
Kelly Greve, PT, DPT, PCS
Carolyn Lehn, PT
Michelle Menner, PT, DPT, CBIS
Catherine, Quatman-Yates, PT, DPT, PhD
Melissa Tally, PT, MPT, ATP
Molly Thomas, PT, DPT, PCS

Abbreviations

- **CP** = Cerebral Palsy
- **GMFCS** = Gross Motor Function Classification System
- **ICF** = International Classification of Functioning, Disability, and Health
- **PT** = Physical Therapist
- **SEMLS** = Single Event Multi-Level Surgery
Objectives

1. Outline evidence-based recommendations for PTs evaluating and treating individuals with CP undergoing SEMLS

2. Explain an evidence-based physical therapy algorithm for individuals with CP undergoing SEMLS

3. Examine case studies across GMFCS levels for physical therapy management in individuals with CP undergoing SEMLS using evidence-based recommendations and an algorithm

4. Discuss gaps in the literature and future research for physical therapy management of individuals with CP undergoing SEMLS
Clinical Questions

In children, adolescents, and young adults, aged 5 years to 25 years, who are diagnosed with CP or other like neuromotor conditions and have had SEMLS:

1. What are the most appropriate therapeutic assessments across the International Classification Functioning, Disability and Health (ICF) framework?
2. What are the most appropriate therapeutic interventions to achieve optimal functional outcomes?

Development of an Evidence-Based Care Guideline – Literature Search

- **Keywords included variations of the following:**
  - cerebral palsy
  - single-event multilevel surgery
  - SEMLS
  - all american
  - single-event multilevel orthopedic surgery
  - physical therapy
  - occupational therapy

- **Databases:** CINAHL, Medline, Pubmed, Ovid
- **Search Timeframe:** 9/1/2014 to 9/15/2015
Development of an Evidence-Based Care Guideline – Literature Search

1773 articles in initial search results

202 full text articles reviewed

129 articles appraised and assigned evidence levels

44 articles used to develop the guideline

Recommendation 1

Using the ICF Framework (Wilson, 2014)

Health condition (disorder or disease)

Body Functions and Structures

Activities

Participation

Environmental Factors

Personal Factors

(WHO 2001)
Recommendation 2

Patients and caregivers be provided with education
- Pre-operative evaluation
- Post-operative expectation
- Functional prognosis based on CP distribution
- Use of orthotics and equipment throughout rehabilitation


Recommendation 3

GMFCS level confirmed pre-operatively by a PT to inform post-operative prognosis


(Palisano 1997, Reid version 2)
Recommendation 4


Recommendation 5

Patient-centered functional goals for post-operative physical therapy intervention be identified with patients and caregivers

- GMFCS levels
- Canadian Occupational Performance Measure (COPM)

Recommendation 6

Consider consults and referrals to other disciplines to promote optimal outcomes
- Pain management
- Physical Medicine & Rehabilitation for spasticity management
- Occupational therapy for activities of daily living
- Dietician or Gastrointestinal for nutrition
- Adaptive Technology Professional for posture


Recommendation 7

Post-operative physical therapy intervention:
- Range of motion
- Scar management
- Strengthening
- Positioning
- Postural training
- Splints and orthoses
- Neuromuscular electrical stimulation
- Transfer training
- Standing program
- Gait Training
  - Treadmill Training
- Endurance training
- Balance training
- Aquatics
- Adaptive Equipment

(Amichai 2009, Buckon 2004, Ganjwala 2011, Grecco 2013,
Patikas 2006, Saraph 2002, Seniorou 2007, Sung 2013,
Thomason 2011, Local Consensus 2017)
Recommendation 8

Continue monitoring patient status with annual, comprehensive physical therapy evaluations for up to 5 years following SEMLS

(Dreher, Buccoliero 2012, Rodda 2006, Thomason 2013, Zwick 2012)
Physical Therapy Management

Pre-operative physical therapy

Goals:
- Physical therapy evaluation (ROM, Modified Tardieu, GMFM, walk test if applicable)
- Pre-operative goal setting
- Identify GMFCS level
- Education on post-operative expectations
- Assess functional prognosis based on GMFCS level and distribution
- Identify status of equipment and orthotics

Physical Therapy Management

Inpatient physical therapy referral

SfMLS Procedure
followed by
Inpatient PT Referral
Physical Therapy Management

Decision Point

Is the patient weight bearing as tolerated?

YES
Intervention: GMFCS level IV:
- Transfer training with appropriate assistive device and assistance
- Bed mobility with appropriate assistance
- Standing with appropriate assistive device and assistance
- Gait training
- Gentle lower extremity ROM
- Equipment assessment (i.e. stander, wheelchair)

NO
Intervention: GMFCS level IV:
- Educate on non-weight bearing transfers and gait
- Bed mobility
- Gait training with appropriate assistive device and assistance
- Gentle lower extremity ROM
- Equipment assessment (i.e. stander, standing board, wheelchair)

Physical Therapy Management

Outpatient physical therapy

- Post-operative evaluation 2-6 weeks post-surgery
- Family education
- Review precautions
- Review pre-operative goals
Physical Therapy Management

Decision Point

Is there difficulty with transfers, gait, standing, bed mobility, or pain?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Inpatient Rehabilitation (Consider for patients with limited access to PT, uncontrolled pain or unmanageable level of caregiver assistance for ADLs)</td>
<td>• Consultative outpatient PT until casts are removed</td>
</tr>
<tr>
<td>• Home Health PT (Consider for patients unable to attend outpatient PT due to complications or lack of access, patients in hip spica casts, or dependent with transfers &amp;2 transfers)</td>
<td>• Provided with outpatient PT if patient does not have casts following surgery</td>
</tr>
</tbody>
</table>

Outpatient physical therapy

- Identify GMFCS level
- Family education
- Review pre-operative goals
- Recommend appropriate outpatient therapy interventions
- Complete appropriate PT assessments
Physical Therapy Management

Outpatient physical therapy assessment for GMFCS level I-IV (Higher Functioning IV)

- COPM
- Pain
- ROM
- HAT
- Modified Tardieu Scale
- SCALE
- Functional Strength
- GMFM
- FMS
- Walk Test
- Gait Analysis
- PEDI
- QOL

Physical Therapy Management

Outpatient physical therapy interventions for GMFCS level I-IV (Higher Functioning IV)

- Scar Management
- ROM
- Postural Training
- Equipment Assessment
- Aquatics
- Strength
- Electrical Stimulation
- Gait Training
- Treadmill Training
- Balance Training
- Endurance Training
Physical Therapy Management

Outpatient physical therapy assessment for GMFCS level IV-V (Lower Functioning IV)

- COPM
- Pain
- ROM
- HAT
- Modified Tardieu Scale
- SCALE
- Functional Strength
- GMFM
- PEDI
- QOL

Physical Therapy Management

Outpatient physical therapy interventions for GMFCS level IV-V (Lower Functioning IV)

- Scar Management
- ROM
- Postural Training
- Equipment Assessment
- Aquatics
- Strength
- Electrical Stimulation
- Balance Training
Physical Therapy Management

Outpatient physical therapy consults and referrals for all GMFCS levels

- Pain Management
- Tone Management
- Gastrointestinal
- Occupational Therapy
- Nutrition
- Orthotics
- Adaptive Equipment

Physical Therapy Management

Reassessment periods post surgery:
- 3 months
- 6 months
- 9 months
- 12 months
- 18 months
- 24 months
Physical Therapy Management

Decision Point

Has the patient returned to baseline functioning?

YES
- Pursue wellness opportunities
- Continue with annual, long-term monitoring (up to 5 years)

NO
- Continue aquatic and land-based physical therapy intervention
- Consider intensive strengthening and gait training
- Education regarding living with a chronic condition
- Review models of care
- Review GAITRite motor scores for GMFCS level
- Pursue wellness opportunities
- Long-term, annual monitoring (up to 5 years)

Case Study of an Ambulatory Patient (GMFCS level I-IV) (High functioning IV)
Case Study 1- GMFCS Level III

Demographics: 7 yo Female

CP Distribution: Spastic diplegia

GMFCS level: III

Gait Analysis: January 2014

Anticipated SEMLS: Left pelvic osteotomy and bilateral hamstring lengthenings

Case Study 1- GMFCS Level III

Pre-Operative Evaluation: June 8, 2015

• ROM: Hip rotation, Hip extension, Knee extension
• Tardieu: Hip adductor, Hamstring, Plantarflexor
• GMFM: Score of 53.38; 50% on curve
• Walk Tests: Pacer gait trainer with arm prompts
  – 1 minute walk test: 65.6 feet
  – 10 meter walk test of 19.96 seconds
Case Study 1- GMFCS Level III

Pre-Operative Evaluation (continued):

- **Patient and Family Education:** Discussed cut-outs for NMES
- **Goal Setting:** Discussed plan for frequency following SEMLS, intensive inpatient versus outpatient
- **Identified current orthotics and equipment**

SEMLS Procedure: June 22, 2015; Left pelvic osteotomy with allograft and bilateral medial hamstring lengthening

LE Immobilization: Long leg extension cast and abduction brace

Precautions: Weight bearing status and hip movement

Weight Bearing Status: Non Weight Bearing

Inpatient Length of Stay: 4 days
Case Study 1- GMFCS Level III

Inpatient Physical Therapy Evaluation:
June 22, 2015
• Frequency: 2-3 visits
• Interventions: Educate caregivers on dependent transfers to/from the wheelchair, positioning with z-flows, and decrease the risks of skin breakdown by floating the heels
• Discharge recommendations: Call PT if concerns arise with transfers; cast care

Outpatient Physical Therapy Evaluation:
August 31, 2015
• Family education: Scar management, hip precautions, prone positioning, knee and ankle ROM, and resuming stander use
• Assessments: Pain, Knee and Ankle ROM, Mobility, COPM
• Frequency recommendations: 1x/week land-based, 1x/week aquatic-based PT
• Consults and Referrals: Occupational Therapy
Case Study 1- GMFCS Level III

Outpatient physical therapy:
• Interventions:
  – Scar Management
  – ROM
  – Positioning
  – Aquatics
  – Electrical Stimulation (Pain Management, Strength)
  – Gait Training (Partial Body Weight Support)
  – Equipment (Dynamic Stander)
  – Orthoses (Bilateral Springleaf AFOs)

Case Study 1- GMFCS Level III

Outpatient physical therapy:
• Additional Interventions:
  – 12 months post surgery, Intensive Locomotor burst of therapy for 4x per week for 5 weeks
Case Study 1- GMFCS Level III

Outpatient physical therapy:
• **Reassessments:**
  – 3 months: Pain limited functional assessment
  – 6 months: Completed in CP Clinic, Walk test during outpatient therapy
  – 9 months: COPM reassessed and new goals set
  – 12 and 14 months: Walk tests repeated
  – 18 months: Gait analysis

Baseline Function by 14 months post surgery (August 2016)
  – Reduced to consultative physical therapy
  – Recommended wellness opportunities (Top Soccer)
Case Study of a Non-Ambulatory Patient (GMFCS level IV-V (Low functioning IV))

Case Study 2- GMFCS Level IV

Demographics: 6 yo Male

CP Distribution: Spastic quadriplegia

GMFCS level: IV

Anticipated SEMLS: Bilateral hip osteotomy due to subluxation
Case Study 2- GMFCS Level IV

Pre-Operative Evaluation: May 2017
• Consult in Ortho Clinic by a Physical Therapist
  – Patient education provided regarding obtaining hip positioner and PT following surgical procedure
  – No clinical examination completed directly prior to surgery
  – Goal setting not completed

• GMFCS Level: IV

Case Study 2- GMFCS Level IV

• SEMLS Procedure: September 14, 2015; Bilateral Pelvic Osteotomies, Hip Varus Derotation Osteotomies, Hamstring Lengthening, Adductor Tenotomy

• Precautions: No aggressive ROM

• Immobilization: Petrie Casts

• Weight Bearing Status: Weight Bearing as Tolerated

• Inpatient Length of stay: 7 days
Case Study 2- GMFCS Level IV

Inpatient Physical Therapy Evaluation:
September 16, 2015
• **Frequency:** 1-2 visits
• **Interventions:** Assess durable medical equipment needs and educate caregivers on dependent transfers to/from the wheelchair, positioning to avoid skin breakdown
• **Discharge recommendations:** Physical therapy orders will be placed after cast removal; contact ortho nursing or local therapist with questions; cast care provided

Case Study 2- GMFCS Level IV

Outpatient Physical Therapy Evaluation:
November 12, 2017
• **Family education:** Review of precautions and transfers; scar massage, gentle ROM, positioning
• **Assessments:** COPM, Pain, ROM, Mobility
• **Frequency recommendations:** 1x/week land-based, 1x/week aquatics for 6-12 weeks then reassess goals to determine ongoing frequency of care
• **Consults and Referrals:** Adaptive equipment, School-based therapy
Case Study 2- GMFCS Level IV

Outpatient physical therapy:
• Interventions
  – Scar Management
  – ROM
  – Positioning
  – Aquatics
  – Equipment utilization (Wheelchair Seating, Car Seat, Stander, Gait trainer)
  – Orthoses (Daytime and Night time AFOs, Knee Immobilizers)

Case Study 2- GMFCS Level IV

Outpatient physical therapy:
• Reassessments:
  – 3 months: Tardieu, pain limited assessment
  – 6 months: No documented assessment
  – 9 months: Tardieu, pain limited assessment
  – 12 months: No documented assessment
  – 18 months: Tardieu, pain limited assessment
  – 24 months: Will complete following hardware removal
Case Study 2- GMFCS Level IV

Outpatient Physical Therapy:
• **Dosing of therapy services**
  – Weekly to every other week through April 2016
  – Every other week to monthly through March 2017
  – Consultative through September 2017
  – Plan to reassess following hardware removal
• **Integration into community and wellness programs**
  – School
  – Aquatics
  – Adaptive sports (Baseball, Soccer)

Gaps in the Literature Related to Physical Therapy Management
Gaps in the literature

- Allied health professionals commonly use the term SEMLS when referring to orthopedic surgeries, however, the definition may differ from one practitioner to another (McGinley 2012, Rodda 2006, Saraph 2001, Thomason 2013)

- SEMLS is effective when supported by physical therapy intervention (Kondratek 2010)
  - Large variations exist in PT management with this patient population (McGinley 2012)

- Inconsistent evidence has been reported on best outcome of SEMLS in reference to pre-operative functional level and age at time of surgery (Noonan 2000, Shore 2010, Westwell 2009)
Future Research for Physical Therapy Management

Future Research

• What is the universal definition for SEMLS?

• Does early tone management influence the recommendations or need for orthopedic surgery?

• Does a pre-operative evaluation with goal setting increase the efficacy of physical therapy intervention in patients recommended for SEMLS?

• What quality of life measure is most appropriate to assess patients across all GMFCS Levels following SEMLS?
Future Research

• What is the optimal dosing for physical therapy across GMFCS levels following SEMLS to reach functional outcomes and quality of life?

• How does adaptive equipment both pre-operatively and post-operatively effect functional outcomes and quality of life in patients following SEMLS?

• What types of lower extremity orthoses and prostheses are appropriate when promoting functional outcomes in patients following SEMLS?

Future Research

• Should there be a greater emphasis on family education for post-operative scar management in this patient population?

• How does aquatic therapy change outcomes in individuals following SEMLS?

• Is electrical stimulation effective in immediate post-operative rehabilitation following SEMLS?

• What community wellness programs effect functional outcomes, quality of life, and overall healthcare costs in patients following SEMLS?
Future Research

• Further investigation is needed on:
  – Physical Therapy dosage
  – Physical Therapy assessments
  – Physical Therapy interventions

Conclusion

• It is crucial that clinical staff be aware of physical therapy recommendations, rehabilitation protocols, and progression of strength and function following SEMLS
  

• Outcome measures that cross the ICF can quantify and identify gaps in care (Wilson 2014) and show improvements following SEMLS (Thomason 2012)
Conclusion

An evidence-based clinical care guideline for physical therapy management of SEMLS with individual with CP has been developed and is available for use by PTs

Contacts:
optsemls@cchmc.org
kelly.greve@cchmc.org
michelle.menner@cchmc.org

References


References


References


