If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.

This handout is for reference only. It may not include content identical to the powerpoint. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.
Pediatric Trauma-Induced Conditions

Occupational therapy intervention across the continuum of care
Patti Sharp, OTD, MS, OTR/L
Cincinnati Children’s Hospital Medical Center

Learning Objectives

• Describe the impact of spinal cord injury, traumatic brain injury, and burn injury on occupational performance in children
• Explain and provide examples of how the role of the occupational therapist changes across the continuum of care for each condition
• Describe how occupational therapists assist patients and families in managing grief following trauma
Post-Trauma Continuum of Care

ICU
Acute
Inpatient Rehab

Outpatient Rehab/Community

Post-Trauma Occupational Therapy Interventions

Preparatory methods

Purposeful activity / Occupation-based intervention

Education
Post-Trauma Scope of Care

Intensive Care Unit

- Care is focused on survival and basic medical recovery
- Child is often sedated
- Child’s crucial occupations are rest and sleep
### Intensive care unit

- **OT Goals**
  - Contracture prevention
  - Ulcer prevention
  - Pain management
  - Safety
  - Introduce family to condition

- **OT Interventions**
  - Stretching
  - Soft tissue mobilization
  - Splinting
  - Bed positioning

### Acute Care

- Increased medical stability
- Increased interaction with environment
- Intervention strives to promote homeostasis and prevent secondary injury
- Pain management – does pain interfere with functional progress?
- May be the longest phase of inpatient care
Acute Care

• OT Goals
  – Resume available motor functions
  – Build tolerance to activity
  – Actively engage child
  – Build rapport
  – Provide in-depth education on condition

• OT Interventions
  – Bedside sitting
  – Transfers
  – Preferred activities

Inpatient Rehab

• Medical stability is established
• Therapy can be provided in a structured, twice daily sessions of all needed disciplines
• Focus is to facilitate independence
• Prepare for transition to home
• Generally the most “intense” phase of care for the child and family
• Multidisciplinary teamwork is crucial for a successful discharge
Inpatient Rehabilitation

• OT Goals
  – Adequate preparation for transition home
  – Increase independence in self-care skills
  – Facilitate continued progress toward prior level of functioning
  – Communicate with other disciplines

• OT Intervention
  – Begin balance between restorative and adaptive approaches

Outpatient Rehabilitation & Community Re-integration

• Care becomes the primary responsibility of the family for the first time
• This is often when reality sinks in and families begin a stage of acute grief
• Progress toward independence pivots on family priorities and values
Outpatient Rehabilitation & Community Re-integration

• OT Goals
  – Identify family priorities and values
  – Clearly identify differences between current and premorbid status
  – Identification of appropriate community resources

• OT Intervention
  – Client-centered interview
  – Self-management strategies to empower the family and child

Pediatric Spinal Cord Injury

• Incidence:
  – 1.99 times per 100,000 children
  – Approximately 0.002%
  – ~1,455 new injuries per year
  – < 4% of all spinal cord injuries

• Gender discrepancy:
  – Boys are twice as likely to experience SCI than girls
Pediatric Spinal Cord Injury

- Causes – traumatic
  - Motor vehicle accident (primary)
  - Violence
  - Falls
  - Sports injury

- Causes – medical
  - Spinal tumor
  - Spinal procedure
  - Disease process

Pediatric Spinal Cord Injury

- Can be at any spinal level
- Young children are more likely to have an upper cervical injury more than other age groups
American Spinal Cord Injury Association Impairment Scale

Pediatric Spinal Cord Injury

<table>
<thead>
<tr>
<th>SPINAL CORD LEVEL</th>
<th>KEY MUSCLES INNERVATED BY THIS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4</td>
<td>Diaphragm and shoulder elevators</td>
</tr>
<tr>
<td>C5</td>
<td>Shoulder flexors and abductors, elbow flexors</td>
</tr>
<tr>
<td>C6</td>
<td>Wrist extensors</td>
</tr>
<tr>
<td>C7</td>
<td>Elbow extensors (triceps)</td>
</tr>
<tr>
<td>C8</td>
<td>Finger flexors, extensors and intrinsics</td>
</tr>
<tr>
<td>T1 – T6</td>
<td>Upper trunk musclos</td>
</tr>
<tr>
<td>T7 – T12</td>
<td>Lower trunk muscles</td>
</tr>
<tr>
<td>L1, L2</td>
<td>Hip flexors</td>
</tr>
<tr>
<td>L3</td>
<td>Knee extensors</td>
</tr>
<tr>
<td>L4</td>
<td>Ankle dorsiflexors</td>
</tr>
<tr>
<td>L5</td>
<td>Toe extensors</td>
</tr>
<tr>
<td>S1 – S6</td>
<td>Ankle plantarflexors, bowel and bladder</td>
</tr>
</tbody>
</table>
Pediatric Spinal Cord Injury

- Major impairments are in motor function
- Motor return will not occur for complete injuries, but is possible for incomplete
- Main focus of therapy is to regain independence in self-care skills and functional mobility
- It is essential to instruct care and injury prevention for non-functional limbs in order to maintain overall health
### SCI in the ICU

#### Preparatory Methods
- Bed positioning
- ROM
- Pain management via collaboration

#### Purposeful Activities
- Communication via adapted call lights

#### Education
- Introductory information
- Pressure area prevention
- Autonomic dysreflexia

### SCI in Acute Care

#### Preparatory Methods
- ROM
- Splinting
- Tone management via collaboration
- Orthostatic hypotension management

#### Purposeful Activities
- Neuromuscular re-education
- Supported sensorimotor activities
- Use of equipment to promote function

#### Education
- In-depth education on SCI
- Model empowerment of the child to direct own care
SCI in Inpatient Rehab

**Preparatory Methods**
- Pain management
- ROM
- Tone/spasticity management
- Positioning schedules
- Pressure relief schedules
- Tenodesis grasp promotion

**Purposeful Activities**
- Developmentally appropriate play
- Task training
- NMES with functional activity
- Movement pattern training
- Bowel & bladder regimen training
- Skin inspections

**Education**
- In-depth, level-specific information
- Preliminary prognosis
- Sexual function
- Safety

SCI in Outpatient & Community

**Preparatory Methods**
- Pain management
- Tone management
- Surgery to promote function

**Purposeful Activities**
- Neuromuscular re-education
- Functional NMES devices
- ADLs, iADLs
- Leisure & exercise activities
- Collaboration with school
- Client-centered goal focus

**Education**
- How to problem-solve environmental barriers to participation
- Referral
- Community resources
- Social supports
Pediatric Traumatic Brain Injury

• Incidence
  – Approximately 1.7 million people per year
  – Ages most likely to incur TBI
    • Young children 0-4 years
    • Teenagers 15-19 years
    • Senior citizens over 65 years

Pediatric Traumatic Brain Injury

• Causes - Traumatic
  – Falls
  – Motor vehicle accidents
  – Sports-related injuries
  – Non-accidental trauma
  – Violence-related

• Causes - Acquired
  – Stroke
  – Anoxia
  – Arteriovenous
    Malformation rupture
  – Tumor resection
  – Seizure activity
  – Seizure foci resection
  – Infection (meningitis, encephalitis)
  – Metabolic disorders
Glasgow Coma Scale

<table>
<thead>
<tr>
<th>BEHAVIOR</th>
<th>RESPONSE</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye opening response</td>
<td>Spontaneously</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>To speech</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Best verbal response</td>
<td>Oriented to time, place, and person</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Confused</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Best motor response</td>
<td>Obey commands</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Moves to localized pain</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Flexion withdrawal from pain</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Abnormal flexion (decorticate)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Abnormal extension (decerbrate)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Total score</td>
<td>Best response</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Comatose client</td>
<td>8 or less</td>
</tr>
<tr>
<td></td>
<td>Totally unresponsive</td>
<td>3</td>
</tr>
</tbody>
</table>

Traumatic Brain Injury

- **Mild**
  - Loss of consciousness < 30 minutes
  - Glasgow Coma Scale score 13-15
  - Post-traumatic amnesia < 24 hours

- **Moderate**
  - Loss of consciousness 30 minutes-24 hours
  - Glasgow Coma Scale score 9-12
  - Observable finding on EEG, CT, or MRI

- **Severe**
  - Loss of consciousness > 24 hours
  - Glasgow Coma Scale score 3-8
  - Significant finding on EEG, CT, or MRI
Pediatric Traumatic Brain Injury

• Functional prognosis
  – Severity of injury
  – Location of injury
  – Extent of injury - localized or diffuse
  – Pre-morbid factors
    • Socioeconomic status
    • Behavior and academic performance
  – Rancho Level of Cognitive Functioning

Rancho Levels of Cognitive Functioning

<table>
<thead>
<tr>
<th>Rancho Los Amigos Scale Levels</th>
<th>Response</th>
<th>Assistance Needed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>No Response</td>
<td>Needs Total Assistance</td>
</tr>
<tr>
<td>Level II</td>
<td>Generalized Response</td>
<td>Needs Total Assistance</td>
</tr>
<tr>
<td>Level III</td>
<td>Localized Response</td>
<td>Needs Total Assistance</td>
</tr>
<tr>
<td>Level IV</td>
<td>Confused-Agitated Response</td>
<td>Needs Maximal Assistance</td>
</tr>
<tr>
<td>Level V</td>
<td>Confused-Inappropriate Response</td>
<td>Needs Maximal Assistance</td>
</tr>
<tr>
<td>Level VI</td>
<td>Confused-Appropriate Response</td>
<td>Needs Moderate Assistance</td>
</tr>
<tr>
<td>Level VII</td>
<td>Automatic-Appropriate Response</td>
<td>Needs Minimal Assistance</td>
</tr>
<tr>
<td>Level VIII</td>
<td>Purposeful-Appropriate Response</td>
<td>Needs Stand-By Assistance</td>
</tr>
</tbody>
</table>
Pediatric TBI – Therapeutic Overview

- Impairments can be motor, neurological, or cognitive
- Return of function is much less predictable due to neuroplasticity of the brain
- Therefore, rehab focus may be in one or many functional areas

TBI in the ICU

<table>
<thead>
<tr>
<th>Preparatory Methods</th>
<th>Purposeful Activities</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Management of autonomic storming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Low stimulation environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sensory stimulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Introductory information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Use of Rancho Levels</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TBI in Acute Care

**Preparatory Methods**
- ROM
- Splinting
- Tone management
- Cognitive assessment
- Sensory stimulation
- Safety measures

**Purposeful Activities**
- Facilitation of interaction with environment
- Functional task grading
- Neuromuscular re-education

**Education**
- In-depth education on TBI
- Impact of repetition on motor re-learning

TBI in Inpatient Rehab

**Preparatory Methods**
- Management of arousal
- Pain management
- Tone management
- ROM

**Purposeful Activities**
- Neuromuscular re-education
- NMES with functional activity
- Cognitive re-training
- Behavior management
- Assessment of visual-perceptual skills

**Education**
- In-depth injury-specific information
- Standardized assessment results
- Preliminary prognosis
## TBI in Outpatient & Community

### Preparatory Methods
- Arousal management
- Pain management
- Tone management
- ROM
- Splinting

### Purposeful Activities
- Neuromuscular re-education
- Constraint-induced movement
- Cognitive re-training
- Cognitive compensatory strategies
- Behavior management

### Education
- Ongoing education regarding neuroplasticity and prognosis
- Alternative treatments and corresponding evidence
- Adaptive strategy and equipment use
- Respite resources
- Community resources
- Social supports

---

### Pediatric Burn Injury

#### Incidence
- Approximately 450,000 per year
- Over 50% of that number consists of children
- Approximately 30,000 children per year require hospitalization for burns

#### Cause
- Scald – 60%
- Flame – 25%
- Contact – 10%
- Electrical/chemical – 5%
Pediatric Burn Injury

Skin Grafting

• Generally performed when an otherwise healthy (non-infected) wound would take longer than 3 weeks to heal on its own
• The only biologically acceptable permanent coverage for a wound of this magnitude is a patient’s OWN skin
Sheet Grafting

Meshed Grafting

continuEd
What is a scar?

- Develops any time the dermal layer of the skin is damaged
- The collagen fibers in hypertrophic scarring are orientated in a “whorl-like” pattern, as compared to normal skin in which collagen aligns in a parallel pattern

Picket fence analogy

withinonesmemory.blogspot.com  diaryofanewmom.net
Scar biology

Who develops scars?

Many factors contribute to how a person heals and develops scars

- **Wound healing is the best predictor**
  - If a wound heals within 2 weeks (closed, not wet), it will scar minimally
  - 14-21 days of wound healing time poses a risk for scarring – 30% incidence of scarring
  - 21+ days of healing will likely lead to hypertrophic scarring, with length of healing time directly related to the extent of hypertrophy – 78% incidence

(Bloemen, 2009; Davoodi, 2008; Deitch, 1983; Staley, 1997)
Who develops scars?

- Scar outcome is highly dependent on genetics and race

- Worst scars:
  - Those with a history or with relatives with a history of hypertrophic scarring
    - Incidence in general population is 1.5-4.5%
  - Those with increased pigment – African Americans, Hispanics, Asians
    - Incidence in these groups is 4.5-16%
  - Following surgery, incidence is 40-70%

(Alster, 2003; Bombaro 2003, Deitch, 1983; Esselman, 2006; Gauglitz, 2011)

Active Hypertrophic Scarring

- Identified by changes in four characteristics of the skin:
  - Vascularity (increases; may be red, pink, purple)
  - Height (increases; thick)
  - Pliability (decreases; firm)
  - Pigmentation (can either decrease or increase; may be hypo or hyper)
Hypertrophic Scarring

Keloid scarring

- Although hypertrophic scars are often referred to as Keloids, this is incorrect.
- Keloids are scars that grow beyond the border of the initial wound boundary.
- It is a genetic condition with generally poor outcomes and minimal treatment options.
So, why does this matter?

- Uncontrolled hypertrophic scarring has both physical and affective repercussions on a child.
- The scar will contract until it meets an equal and opposite force.
- Scar tissue is estimated to have 12 times the contractile strength of normal skin, which is clearly strong enough to pull features and joints out of place.

Functional problems

- If a scar crosses a joint, it can limit range of motion and cause functional deficits.
Contractures due to uncontrolled scar

Pediatric Burns – Therapeutic Overview

• Major impairments are in soft tissues, which result in primarily motor deficits
• Treatment focus is on maximizing skin integrity and function, then resuming participation in occupations
• It is essential to discuss and facilitate acceptance of changes in the physical body
Burns in the ICU

**Preparatory Methods**
- Anti-deformity positioning
- Protective splinting
- PROM 1x/day

**Purposeful Activities**
- Acknowledge the child
- Investigate interests

**Education**
- Introductory information

---

Burns in Acute Care

**Preparatory Methods**
- Aggressive scar massage and PROM 2x/day 5-10 days post wound closure
- Splinting
- Initiation of pressure therapy

**Purposeful Activities**
- Child-centered non-pharmaceutical pain management
- Follow rote ROM by graded functional activities

**Education**
- In-depth information on burns and scarring
- Observation of therapy sessions
- Sample scar management devices
- Photos of scar progression
**Burn in Inpatient Rehab**

<table>
<thead>
<tr>
<th>Preparatory Methods</th>
<th>Purposeful Activities</th>
<th>Education</th>
</tr>
</thead>
</table>
| • Aggressive ROM 2x/day  
• Splinting | • Follow all ROM exercises with age- and interest-appropriate functional skills | • In-depth injury-specific information  
• Hands-on instruction of ROM HEP  
• Modeling of empathetic management of the child’s tolerance of the HEP |

**Pressure Garments**

![Pressure Garments](image_url)
Burns in Outpatient & Community

<table>
<thead>
<tr>
<th>Preparatory Methods</th>
<th>Purposeful Activities</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ROM</td>
<td>• Resuming engagement in client-specific occupations</td>
<td>• Importance of maintaining HEP through scar maturation</td>
</tr>
<tr>
<td>• Scar massage</td>
<td>• Redefinition of self as a burn survivor</td>
<td>• School re-entry</td>
</tr>
<tr>
<td>• Pressure therapy</td>
<td></td>
<td>• Social supports</td>
</tr>
<tr>
<td>• Splinting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Progressive exercise</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment / Phase of Care</th>
<th>Client Performance Skills and Occupations</th>
<th>Client Factors: Body Structure and Function</th>
<th>Client Context: Caregivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive Care Unit</td>
<td>Sleep/rest</td>
<td>Healing</td>
<td>Understanding situation and condition</td>
</tr>
<tr>
<td></td>
<td>o Minimal intervention</td>
<td>o Infection control</td>
<td>o Education on condition and role of OT specific to phase of care and interventions provided</td>
</tr>
<tr>
<td></td>
<td>o Schedule around medical interventions</td>
<td>o Wound care</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Comfort measures</td>
<td>o Precautions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Low stimulation environment</td>
<td>o Monitoring of vitals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Healing/recovery</td>
<td>• Safety - Prevention of secondary injury</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Introduce self, acknowledge patient</td>
<td>o Bed positioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o PROM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Physical safety measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[CONTINUED]
<table>
<thead>
<tr>
<th>Environment / Phase of Care</th>
<th>Client Performance Skills and Occupations</th>
<th>Client Factors: Body Structure and Function</th>
<th>Client Context: Caregivers</th>
</tr>
</thead>
</table>
| Acute Hospitalization       | • Tolerance of medical/therapy interventions  
  o Developmentally appropriate education  
  o Medical play  
  o Use of distraction  
  • Resuming component skills (motor and cognitive)  
  o Changing positions, transferring  
  o Gradual increase in therapeutic activities and functional skills  | • Healing  
  o Infection control  
  o Wound care  
  o Precautions  
  o Monitoring of vitals  
  • Safety - Prevention of secondary injury or deformity  
  o Bed positioning  
  o Splinting  
  o PROM  
  o Physical safety measures  
  • Preparation for rehab activity increase  
  o Weight bearing  
  o AAROM  
  o Sensory Stimulation  | • Understanding situation and condition  
  o Education on condition and role of OT specific to phase of care and interventions provided  
  • Providing support for child  
  o Modeling  
  • Grief support  
  Supporting medical team  
  o Ongoing education and explanation of interventions |
| Inpatient Rehabilitation    | • Resuming component skills (motor and cognitive)  
  o Gradual increase in therapeutic activities and functional skills  
  • Resuming functional skills (ADLs)  
  o Gradual increase in therapeutic activities and functional skills  
  • Avoidance of learned helplessness  
  o Celebration and acknowledgement of successes  
  • Pain management  
  o Biofeedback  
  o Distraction  
  • Preparation for discharge  
  o Education  
  o Planning  
  o Community outing  | • Rehabilitation of impaired body structures  
  o ROM  
  o Strengthening  
  o NMES  
  o Tissue mobilization  
  o Cognitive stimulation  
  o Weight bearing  
  • Biomechanical function despite impairments  
  o Activity modification  
  o Adaptive equipment  | • Understanding situation and condition  
  o Education on condition and role of OT specific to phase of care and interventions provided  
  • Providing support for child  
  o Modeling  
  • Facilitating rehabilitation  
  o Education, support, modeling  
  o Celebration and acknowledgement of successes  
  • Resuming parenting role  
  o Education, support, modeling  
  • Preparation for completing HEP at home  
  o Education on importance and potential for dysfunction if not completed (compliance book)  
  o Rehearsal |
### Client Performance Skills and Occupations

- Completing the HEP
  - Education on importance and potential for dysfunction if not completed (compliance book)
  - Reward systems
- Enhancing/Refining ADLs
  - Task modification, strategizing, and rehearsal
- Independence in client-centered occupations within the chosen environment
  - Client-specific goal setting
  - Occupational exploration
  - Task modification, strategizing, and rehearsal

### Client Factors: Body Structure and Function

- Rehabilitation of impaired body functions
  - Rote exercise followed by functional task rehearsal; transition of rote exercises to HEP
  - Monitoring and modification of orthotics and prosthetics
- Biomechanical function despite impairments
  - Activity modification
  - Adaptive equipment
- Engagement with consideration to remaining impaired body structures/functions
  - Activity modification
  - Adaptive equipment

### Client Context: Caregivers

- Understanding situation and condition
  - Education on condition and role of OT specific to phase of care and interventions provided
- Completing the HEP
  - Review of importance and potential for dysfunction if not completed (compliance book)
  - Rehearsal and modification, re-education as needed
- Facilitating ongoing engagement and independence
- Re-establishing routine and boundaries
- Facilitating re-engagement in chosen community environments and occupations

---

**Diagram:**
- **ICU**
- **Acute**
- **Inpatient Rehab**
- **Outpatient Rehab/Community**

**Legend:**
- Rehabilitation
- Adaptation

**Note:**
- Continued
Grieving & acceptance

"NORMAL" FUNCTIONING

Shock and Denial
- Avoidance
- Confusion
- Fear
- Numinous
- Denial

Anger
- Frustration
- Anxiety
- Imitation
- Emasculation
- Shame

Depression and Detachment
- Overwhelmed
- Blahs
- Lack of energy
- Helplessness

Stages of the Grief Cycle

RETURN TO MEANINGFUL LIFE

- Empowerment
- Security
- Self-acceptance
- Meaning

Acceptance
- Exploring options
- A new plan in place

Dialogue and Bargaining
- Reaching out to others
- Desire to tell one's story
- Struggle to find meaning for what has happened

Adapted from Kübler-Ross, 1969
I welcome questions and comments!

Patti Sharp, OTD, MS, OTR/L

Patricia.sharp@cchmc.org

513-803-1977