Traumatic Brain Injuries in Early Childhood: Recognizing, Recovering, Supporting

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Training Provided by a Collaboration:

- University of Missouri-MO Head Start- State Collaboration Office
- Missouri Head Start Association
- Thompson Center for Autism and Neurodevelopmental Disorders, University of Missouri Columbia-Department of Health Psychology
- Missouri Department of Health and Senior Services-MO TBI Implementation Partnership Project
Funding for this training is provided in part by:

1.) H21MC06740 from the Department of Health and Human Services (DHHS) Health Resources and Services Administration, Maternal and Child Health Bureau. The contents are the sole responsibility of the authors and do not necessarily represent the official views of DHHS.

2.) Missouri Head Start State Collaboration Office
Acknowledgement

Much of the following information is adapted from “Understanding Students with Brain Injury,” a series of manuals developed by the Center for Innovations in Special Education, University of Missouri-Columbia.
Overview

• Typical Development
• Basic Brain Anatomy
• Definition of Traumatic Brain Injury
• Mechanisms of Injury and Measuring Severity
• Recovery
• Cognitive and Behavioral Impact of TBI
• How to Help an Injured Child in Your Classroom
• What to Do if a Child is Injured In Your Care
• How to Recognize TBI in your Classroom
Typical Development and Basic Brain Anatomy
Basic Brain Anatomy
Basic Brain Anatomy
Basic Brain Anatomy

Cerebrum

*Pituitary gland

*Pineal gland

Brain stem

Cerebellum

Spinal cord

*Pineal and pituitary glands are deep inside the brain

National Cancer Institute
Basic Brain Anatomy

The meninges are the membranes covering the brain and spinal cord.

- Dura mater (2 layers)
- Arachnoid
- Pia mater
- Brain
Basic Brain Anatomy

(a) Cerebral ventricles of the brain

Lateral ventricles

Third ventricle

Fourth ventricle

Biological Psychology 5e, Figure 2.19 (Part 1)
Basic Brain Anatomy

(c) Lateral view

Anterior cerebral artery
Middle cerebral artery
Posterior cerebral artery

*Biological Psychology 5e, Figure 2.20 (Part 3)*
Basic Brain Anatomy

• Localized functions

• Connectivity and feedback loops

• Hierarchical organization
Basic Brain Anatomy

(a) Lateral view

Frontal lobe
Precentral gyrus
Central sulcus
Postcentral gyrus
Parietal lobe
Occipital lobe
Olfactory bulb
Sylvian fissure
Temporal lobe
Cerebellum

Biological Psychology 5e, Figure 2.12 (Part 1)
Basic Brain Anatomy

Corpus callosum

Biological Psychology 5e, Figure 2.18
Traumatic Brain Injury: Definition and Prevalence
Traumatic Brain Injury

• Educational Category Defined By:
  – Acquired injury
  – Caused by an external force
  – Open or closed injury
  – Results in total or partial physical disability, psychosocial impairment, or both
  – Excludes: congenital, degenerative, or birth injuries

• Contrast with Acquired Brain Injury
Estimated Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by Age Group, United States, 2002-2006

Children, older adolescents, and adults ages 65 years and older are more likely to sustain a TBI

Estimated Average Annual Rates of Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths, by Sex, United States, 2002-2006

In every age group, TBI rates are higher for males than females.

Mechanisms of Injury
Mechanisms of Injury

*Pineal gland

*Pituitary gland

Brain stem

Cerebellum

Spinal cord

*Cerebrum

*Pineal and pituitary glands are deep inside the brain

National Cancer Institute
Mechanisms of Injury

• Primary Mechanisms

• Secondary Mechanisms
## Mechanisms of Injury

<table>
<thead>
<tr>
<th>Glasgow Coma Score (also Pediatric Glasgow Coma Score)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>Rate 1-4</td>
</tr>
<tr>
<td>Verbal</td>
<td>Rate 1-5</td>
</tr>
<tr>
<td>Motor</td>
<td>Rate 1-6</td>
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</table>
# Measuring Injury Severity

## Glasgow Coma Scale

<table>
<thead>
<tr>
<th>Severity</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13-15</td>
</tr>
<tr>
<td>Moderate</td>
<td>9-12</td>
</tr>
<tr>
<td>Severe</td>
<td>3-8</td>
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</table>
Measuring Injury Severity

• Post-Traumatic Amnesia
  – Period of confusion following a TBI
  – Includes disorientation
  – Inability to remember continuous events occurring after the injury

• Children’s Orientation and Amnesia Test (COAT)
Recovery Process
Initial Recovery

Mild/Concussion

- Emergency Room
- Released Home
- Back to School

Moderate/Severe

- Emergency Response
- Inpatient Hospitalization
- Inpatient Rehabilitation
- Outpatient Rehabilitation
- School Re-Entry
Inpatient Team Members

- Physicians and Nurses
- Physical Therapist
- Occupational Therapist
- Speech/Language Pathologist
- Neuropsychologist/Rehabilitation Psychologist
- Psychiatrist
- Social Worker
- Learning Specialist
Initial Recovery

Mild/Concussion
- Emergency Room
- Released Home
- Back to School

Moderate/Severe
- Emergency Response
- Inpatient Hospitalization
- Inpatient Rehabilitation
- Outpatient Rehabilitation
- School Re-Entry
Recovery

Number of Symptoms

Baseline 1 month 3 months 6 months 9 months 12 months

Adapted from Taylor et al., 2010
Factors Influencing Recovery

- Injury Factors
- Child Factors
- Environmental Factors
Severity of the Injury

0  No Hurt
1  Hurts Little Bit
2  Hurts Little More
3  Hurts Even More
4  Hurts Whole Lot
5  Hurts Worst
Severity and Cognitive Recovery

Trends in neurocognitive outcomes and recovery over time

From Babikian & Asarnow, 2009
Concussion

- Controversy about long-term effects
- Subset of children show significant and persisting cognitive, behavioral, emotional problems
  - Younger children
  - More serious injury
  - Worse functioning before injury
  - Worse family functioning
- Headache
- Dizziness
- Fatigue
- Sleep problems
- Sensitivity to light
- Forgetfulness
- Concentration
- Mood problems
Post-Concussive Symptoms

From Yeates et al., 2010
Factors Influencing Recovery

- Injury Factors
- Child Factors
- Environmental Factors
Child Factors

Child’s Age
Child’s Functioning
Before the Injury
Factors Influencing Recovery

- Injury Factors
- Child Factors
- Environmental Factors
Environmental Factors

Resources and Socioeconomic Status

Family Functioning

Support

Adjustment
Cognitive and Behavioral Impact of TBI
Impact of TBI

- Physical/Sensory
- Behavioral
- Cognitive
- Emotional
Physical and Sensory Problems

- Fatigue and sleep problems
- Headaches
- Seizures
- Bladder/bowel problems
- Temperature regulation
- Orthopedic problems
- Vision problems
- Hearing problems
- Sensory sensitivity
- Motor problems
## Cognitive Problems

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<tr>
<th>Intellectual (IQ)</th>
<th>Memory</th>
<th>Attention</th>
<th>Executive Function</th>
<th>Communication</th>
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<td>Verbal reasoning</td>
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<td>Auditory attention</td>
<td>Working memory</td>
<td>Organizing verbal responses</td>
<td>Eye contact</td>
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<td>Visual-spatial reasoning</td>
<td>Retention</td>
<td>Visual attention</td>
<td>Planning</td>
<td>Organizing written responses</td>
<td>Facial expressions</td>
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<td>Information processing speed</td>
<td>Retrieval</td>
<td>Divided attention</td>
<td>Organizing</td>
<td>Keeping on topic</td>
<td>Body language</td>
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<td>Slower learning curve</td>
<td>Slower problem-solving</td>
<td>Mental flexibility</td>
<td>Discourse</td>
<td>Personal space</td>
<td></td>
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<td></td>
<td></td>
<td>Abstract thinking</td>
<td></td>
<td>Social information processing</td>
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Effects on IQ

From Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2009
## Cognitive Problems

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Behavior Problems

Impulsivity

Self-Regulation

Low Motivation

Poor Judgment

Lethargic
Emotional Problems

- Depression
- Emotion Regulation
- Anxiety
- Mood Changes
- Anger and Irritability
Impact of TBI

- Physical/Sensory
- Cognitive
- Behavioral
- Emotional
Academic Problems

- Reading
- Number concepts and arithmetic
- Writing
- Academic facts
Math Achievement

Adapted from Ewing-Cobbs et al., 2004
Spelling Achievement

Adapted from Ewing-Cobbs et al., 2004
Reading Recognition Achievement

Adapted from Ewing-Cobbs et al., 2004
Social Problems

Aggression

Loneliness

Poor Social Problem-Solving

Bossiness

Suggestibility
Adaptive Problems

Self Care

Safety Skills

Self Direction

Self-Regulation
Working with a Child with TBI
Educator’s Role

• Integral team member

• Collaborate with other service providers and parents

• Frequent monitoring

• Appropriate accommodations and supports
Parent’s Role

- Watchful attention
- Communicate with all providers
- Advocate for supports and services
- Provide support and encouragement
- Attend to family’s well-being
Supporting the Child

- Health Plan
- Schedule
- Behavior Supports
- Structure
- Attention, Learning and Memory
• Obtain needed information from child’s medical providers

• Schedule medication administration

• Provide needed accommodations to address physical limitations

• Develop a written plan
Schedule

- Modified schedule
- Alternate physical and academic activities
- Scheduled breaks
Structure

- Structure
- Predictability
- Routines
  - Visual Schedule
  - Instructional Routines
Visual Schedules

turn on water  soap  wash hands  turn off water  dry hands

wake up  bathroom  take off pajamas  put on clothes

eat  brush teeth  comb hair  bus

http://www.do2learn.com/
**Visual Schedule**

<table>
<thead>
<tr>
<th>Circle Time</th>
<th>Play Time</th>
<th>Rest Time</th>
<th>Snack Time</th>
<th>Skill Time</th>
<th>Story Time</th>
<th>Action Time</th>
<th>Good Bye!</th>
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<tr>
<td><img src="image1" alt="Circle Time" /></td>
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<td><img src="image6" alt="Story Time" /></td>
<td><img src="image7" alt="Action Time" /></td>
<td><img src="image8" alt="Good Bye!" /></td>
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http://www.preschoolplaybook.com/2008/10/visual-schedule.html
Instructional Routines

• Getting the child’s attention
• Explain the activity
• Model the activity ("I’ll do it")
• Children do activity with teacher ("We do it")
• Child does activity alone ("You do it")
• Teacher gives feedback
• Review
- Avoid overstimulation
  - Designated quiet space
  - Remove unnecessary materials

- Look for signs of fatigue
  - Give breaks as needed

- Keep instructions simple

- Present information in interesting, active ways
Learning and Memory

- Brisk Pace
  - Slower pace for new material
- Check in with child
- Small chunks of information over several days
- Frequent repetition and review
- Present information in more than one way
Behavior Supports

• Anticipate problems and triggers
  – Transitions and changes
  – Unstructured activities
  – Time of day/fatigue

• Set up the environment for success
  – Reduce stimulation and distraction
  – Provide breaks
  – Re-direct the child
  – Give reminders and cues
• Give lots of specific positive reinforcement
  – I like how you kept your hands to yourself
  – Great job asking for help

• Formal behavior plan
  – Increase appropriate behaviors
  – Decrease negative behaviors

• Functional Behavior Assessment
Additional Supports and Services

- Individual therapy
  - Cognitive rehabilitation
  - Building coping skills

- Family counseling
  - Improving family functioning
  - Family problem-solving
When a Child Is Injured in Your Care
What to Do if a Child is Injured in Your Care

• Follow standard first aid procedures

• Make sure the child is evaluated by a physician
What to Do if a Child is Injured in Your Care

• When did the injury occur?
• What did the child hit his/her head on?
• How did it happen?
• What part of the child’s head was injured?
• How did the child behave after the injury?
  – Loss of consciousness
  – Seeming dazed, confused, or disoriented
  – Periods of blank staring and/or frank seizure
  – Vomiting and/or headache
  – Irritability, fussiness
• How long did any changes in behavior last?
Recognizing TBI in Your Classroom
How to Recognize TBI in Your Classroom

• Any child who shows a change in behavioral or cognitive functioning should be evaluated

• Changes in behavior following a known head injury warrant specialty attention
How to Recognize TBI in Your Classroom

• Notable changes may include:
  – Irritability or moodiness
  – Fatigue
  – Withdrawn behavior
  – Impulsivity
  – Complaints of headaches
  – Trouble learning new information
  – Slow speed of processing
References


Resources

• Centers for Disease Control and Prevention
  – http://www.cdc.gov/traumaticbraininjury/

• Brain Injury Association of America
  – http://www.biausa.org/

• Brain Injury Association of Missouri
  – http://www.biamo.org/new_page0.aspx

• LearnNet
  – http://www.projectlearnnet.org/