Neurobehavioral Issues Following Traumatic Brain Injury

Part I

Traumatic Brain Injury:
An Overview

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TRAUMATIC BRAIN INJURY
A Brief Overview

A Webcast Presentation

by

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ACQUIRED BRAIN INJURY (ABI)

INFECTIOUS  NEUROTOXIC
METABOLIC  TRAUMATIC
NEOPLASTIC  VASCULAR
DEGENERATIVE/ DEMENTING

EPI DEMIOLOGY OF TBI
[CDC (NCIPC), 1995-2001]

ESTIMATED 1.4 MILLION PERSONS/ YEAR
• HOSPITALIZED: 235,000 PERSONS/ YEAR
• EMERGENCY ROOM TREATMENT: 1.1 MILLION PERSONS/ YEAR
ANNUAL RATES of TBI [CDC (NCIPC), 1995-2001]

- 506.4/100,000 POPULATION (TOTAL)
- 403.1/100,000 POPULATION (ER VISITS)
- 85.2/100,000 POPULATION (HOSPITALIZATIONS)

EPIDEMIOLOGY of TBI

- CHILDREN / ADOLESCENTS
- YOUNG ADULTS
- ELDERLY (≥ 75 YEARS OF AGE)

EPIDEMIOLOGY of TBI (SEX RATIOS)

MALES >> FEMALES

(1.5-2 : 1)
**CAUSES of TBI**  
[CDC (NCIPC), 1995-2001]

- FALLS
  - CHILDREN 0-4 YEARS
  - ADULTS ≥ 75 YEARS
- MOTOR VEHICLES-RELATED OCCURRENCES
- ASSAULT

**INTENTIONAL CAUSES of TBI**

- MILITARY COMBAT
- VIOLENT CRIMINAL BEHAVIOR
- HOMICIDE AND SUICIDE ATTEMPTS
- DOMESTIC VIOLENCE
- CHILD ABUSE

**EPIDEMIOLOGY of TBI**  
(RISK FACTORS)

- NON-USE of PREVENTION STRATEGIES  
  (e.g. seatbelt, helmet)
- PSYCHIATRIC/BEHAVIORAL DISORDER
- PSYCHOSOCIAL/ENVIRONMENTAL FACTORS
- SUBSTANCE ABUSE
INTOXICATION and TBI

> 17,000 DEATHS / YEAR  
(Vehicular Homicide Rate: One Person/30 Minutes)

500,000 DWI-RELATED INJURIES/YEAR  
(One Person/Minute)

MADD (2002)

MORTALITY and TBI  
[CDC (NCIPC), 1995-2001]

• 50,000 DEATHS/YEAR (3.6%)

• HIGHEST DEATH RATE: PERSONS > 75

TRAUMATIC BRAIN INJURY

ACUTE SEQUELAE

and

PATHOPHYSIOLOGY
TBI SUBTYPES

- CLOSED HEAD INJURY
- PENETRATING HEAD INJURY
- BIRTH INJURY

GLASGOW COMA SCALE
(Teasdale & Jennett, 1974)

- MOTOR RESPONSE
- VERBAL RESPONSE
- EYE OPENING RESPONSE

GLASGOW COMA SCALE

- **< 8** = SEVERE TBI
- **9 -12** = MODERATE TBI
- **12 -15** = MILD TBI
TRAUMATIC BRAIN INJURY

POST-CONCUSSION SYNDROME

POST-CONCUSSION SYNDROME (PCS)

- MINOR/ MILD TBI
- ASSOCIATED WITH BRIEF or NO LOC
- MAY BE ASSOCIATED WITH WHIPLASH EVENT

CLINICAL SYMPTOMS in PCS

- HEADACHE
- DIZZINESS/ VERTIGO
- PHOTOHOBIAS/ BLURRED VISION
- NAUSEA/ VOMITING
- SLEEP DISORDER
- TINNITUS
CLINICAL SYMPTOMS in PCS

- IRRITABILITY/EMOTIONAL LABILITY
- DIMINISHED STAMINA/FATIGUE
- IMPAIRMENT OF ATTENTION/CONCENTRATION
- SECONDARY MEMORY IMPAIRMENT

NEURODIAGNOSTIC FINDINGS

- GLASGOW COMA SCALE: 13-15
- CT/MRI FINDINGS TYPICALLY NEGATIVE
- EEG USUALLY NORMAL
- NEUROPSYCHOLOGICAL TEST RESULTS WNL

PERSISTENT PCS SYMPTOMS (RISK FACTORS)

- ↑AGE
- HISTORY OF MULTIPLE CONCUSSIONS
- PRE-EXISTING PSYCHIATRIC DISORDER
PERSISTENT PCS SYMPTOMS (RISK FACTORS)

• MISDIAGNOSIS/ LACK OF APPROPRIATE DIAGNOSIS/TREATMENT
• FAILURE TO RECOGNIZE SIGNIFICANT PATHOPHYSIOLOGICAL SEQUELAE, ASSOCIATED WITH APPARENT “MINOR” INJURY

TRAUMATIC BRAIN INJURY

MODERATE/ SEVERE INJURY

PATHOPHYSIOLOGY of TBI

• LOC/ COMA
• COUP AND CONTRECoup CONTUSIONS
• FRONTOTEMPORAL CONTUSIONS
PATHOPHYSIOLOGY of TBI

• CEREBRAL EDEMA
• COMPRESSION and HERNIATION
• DIFFUSE AXONAL INJURY (DAI)
DIFFUSE AXONAL INJURY (DAI)

- INTRAHEMISPHERIC CONNECTIONS
  - Ascending Pathways
  - Descending Pathways
  - Cortical Connections

- INTERHEMISPHERIC COMMISSURES
  - Anterior Commissure
  - Corpus Callosum

ACUTE COMPLICATIONS of TBI

- CARDIOPULMONARY ARREST
- SKULL FRACTURE
- HEMORRHAGE/HEMATOMA
  - Epidural
  - Subdural
  - Intracerebral
- HYDROCEPHALUS
ACUTE COMPLICATIONS of TBI

- SYSTEMIC COMPROMISE (e.g., shock)
- INFECTION
- ENDOCRINOPATHY
- POST-TRAUMATIC SEIZURES

SHAKEN BABY/SHAKEN IMPACT SYNDROME

- SUBDURAL HEMATOMA/INTRACEREBRAL HEMORRHAGE
- RETINAL/PRE-RETINAL HEMORRHAGE
- CEREBRAL EDEMA
- ± SKULL FRACTURE

PENETRATING HEAD INJURY

- TYPE of PROJECTILE/WEAPON
- VELOCITY and DISTANCE
- TRAJECTORY
TBI: POST-ACUTE SEQUELAE

- PHYSICAL DISABILITY
- SENSORY IMPAIRMENT
- NEUROCOGNITIVE DEFICITS
- NEUROBEHAVIORAL/PSYCHIATRIC DISORDER

NEUROCOGNITIVE CONSEQUENCES of TBI
Disorders of Attention/Arousal

- Difficulty sustaining concentration or dividing attention
- Distractibility and diminished capacity to resist interference from competing stimuli
- Inattention or neglect (ignores stimuli typically on one side of space)
- Hypoarousal and persistent lethargy
# NEUROCOGNITIVE CONSEQUENCES of TBI

## Disorders of Memory

- Post-Traumatic Amnesia (PTA)
- Impaired ability for acquisition of new information, verbal and/or non-verbal
- Difficulty with retrieval of information
- Persistent amnesia

## Disorders of Language

- Word-finding or naming difficulty (anomia)
- Diminished verbal fluency
- Difficulty with articulation of speech (dysarthria)
- Difficulty with expression and/or comprehension of language (traumatic aphasia)
- Impairment of cognitive-linguistic skills (e.g., reading, spelling)

## Disorders of Executive Skill

- Difficulty with initiating and/or sustaining purposeful activity
- Impairment of organizational and problem-solving skills
- Diminished capacity to develop and execute well-formulated plans
NEUROCOGNITIVE CONSEQUENCES of TBI
Disorders of Executive Skill

- Cognitive inflexibility, evidenced in perseveration and limited capacity to generate alternative strategies/integrate feedback
- Limited capacity for insight and reasoning
- Diminished capacity for recognizing or anticipating the consequences of one's own behavior

NEUROBEHAVIORAL CONSEQUENCES of TBI

- DEPRESSION
- PERSONALITY CHANGE

NEUROBEHAVIORAL CONSEQUENCES of TBI
DORSOLATERAL PFC SYNDROME

- EXECUTIVE SKILL DEFICITS
- IMPAIRMENT OF WORKING MEMORY
- FLAT AFFECT/ PSEUDODEPRESSION
- STIMULUS-BOUND BEHAVIOR
NEUROBEHAVIORAL CONSEQUENCES of TBI ORBITOFRONTAL PFC SYNDROME

- RELATIVELY PRESERVED NEUROCOGNITIVE SKILLS
- IMPAIRED SOCIAL SKILLS/ PSEUDOSOCIOPATHY
- DISINHIBITION/ EMOTIONAL DYSREGULATION
- HYPOMANIA/MANIA/ PSEUDOPSYCHOPATHY

POST-ACUTE SECONDARY DISORDERS

- COMPROMISED EDUCATIONAL OUTCOME
- COMPROMISED VOCATIONAL OUTCOME
- SOCIAL ISOLATION

POST-ACUTE SECONDARY DISORDERS

- SUBSTANCE ABUSE
- INSTITUTIONALIZATION
- INCARCERATION
FACTORS AFFECTING RECOVERY and OUTCOME

- AGE
- SEVERITY OF INJURY
- DURATION OF UNCONSCIOUSNESS
- DURATION OF POST-TRAUMATIC AMNESIA (PTA)

FACTORS AFFECTING RECOVERY and OUTCOME

- NATURE OF COMPLICATIONS
- PREMORBID CONDITIONS (e.g., Psychiatric Disorder, Developmental Disorder)
- TIMELINESS, APPROPRIATENESS, ACCESS to, and ADEQUACY OF REHABILITATION

FACTORS AFFECTING RECOVERY and OUTCOME

- AWARENESS of, ACCESS to, PROVISION of
  - ENTITLEMENTS (e.g., Special Education, Medicaid)
  - OTHER SERVICES/INTERVENTIONS
- OTHER POST-INJURY RISKS/FACTORS (e.g., substance abuse)
- FAMILY SUPPORT
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Following a 10 minute break, Dr. LaVecchia will answer questions.
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