Objectives

- Participants will be able to identify variable causes of anoxic BI
- Participants will be able to identify interventions that may be utilized to assist in the recovery from ABI
- Review several case studies

ANOXIC BRAIN INJURY

- Anoxic brain damage is injury to the brain due to a lack of oxygen.
- Hypoxia is the term to describe low oxygen.
- Cerebral hypoxia is a form of hypoxia (reduced supply of oxygen), specifically involving the brain; when the brain is completely deprived of oxygen, it is called cerebral anoxia.

Causes of Cerebral Anoxia

- Cardiac Arrest
- Asthma
- Anemia
- Status epilepticus
- Choking
- Drowning
- Strangulation
- Smoke inhalation
- Drug overdose
- Shock
- Crushing of the trachea
- Ascent from deep water diving
- Flying in high altitudes without a pressurized cabin
- The “Fainting” game

Anoxic Brain Injury

- Approximately 180,000-450,000 people in the United States are dying because of sudden cardiac arrest per year
- ~100,000 people are treated in the United States each year for out of hospital cardiac arrest (OHCA)
- Improved pre-hospital emergency care, Pts surviving resuscitation and suffering severe hypoxic brain damage is increasing
- 7.6% of treated OHCA patients survive to hospital discharge
- Less than 50% of patients who are admitted to the ICU after OHCA will be discharged from the hospital
- Broad spectrum: from full recovery, coma—death
- Trials show 27% of post hypoxic coma Patients regain consciousness within 28 days, 9% remain comatose or vegetative, 64% died.

Case Study 1 - Derek

- 23 year old male s/p v-fib arrest secondary to aspiration pneumonia
- Down and unconscious for unknown period of time
- 20 minutes of CPR; epinephrine x2; bicarbonate x1; shock x1
- Blood alcohol content= 438 at admission; urine toxicology screen= negative
- Past medical history: hearing loss in R ear; depression
- Past social history: Independent prior to admission and worked in family business
Case Study 1 - Derek

Inpatient Brain Injury Rehabilitation
Disorders of Consciousness Program
Paroxysmal Sympathetic Hyperactivity
Tracheostomy and PEG
5 weeks post event
~ 6 week length of stay

Case Study 1 - Derek

Occupational Therapy:
- Eye opening 100% with no command following noted on evaluation
- No auditory startle or flexion withdrawal in all four extremities
- Total assist for self care and transfers
- Nystagmus during questionable visual tracking

Case Study 1 - Derek

One week post OT evaluation:
- Minimal visual tracking
- Unable to cross midline visually
- Cervical range of motion and upper extremity passive range of motion

2 weeks post OT evaluation:
- Occasionally vocalizing on command
- Remains total assistance for sitting balance, transfers, and self care skills
- Able to attend to midline visually for up to 10 seconds

3-4 weeks post OT evaluation:
- Vocalizing throughout sessions; facial grimacing and facial twitching
- Family training and education
- Fluctuating attention to auditory stimulation
- Fluctuating body centered command following

5-6 weeks post OT evaluation:
- Family training and education
- Localization to auditory stimulus
- Able to localize and fixate on a target visually with head turns

Speech Therapy:
- Demonstrated reflexive swallow 4 times on evaluation
- Strong cough present and requiring suctioning to clear secretions from tracheostomy
- Nonverbal and did not follow commands on evaluation
- PMV trialed
- Coma Recovery Score completed= 3 out of 23

One week post ST evaluation:
- Eye opening 100% of sessions
- Spontaneous vocalizations
- Tolerating PMV for ~45mins with stable saturation levels
- Visual startle and flexion withdrawal in bilateral lower extremities noted.

2 weeks post ST evaluation:
- Trach capped-decannulation
- Perseverative vocalizations
- Tracking loud auditory stimulus on the left

3-4 weeks post ST evaluations:
- Coma recovery scale ongoing
- Auditory localization
- Eye opening without simulation
- Oromotor movement

5-6 weeks post ST evaluations:
- Continues to demo auditory localization
- Fluctuating visual startle
- Reflexive vocalizations
- Family training

Physical Therapy
- Total assistance level for bed mobility and transfers (quad pivot & hoyer); ambulation and stairs not appropriate on evaluation
- Eye opening 100% of session
- Spasticity noted on R hemi body with flaccidity on the left
- Vital Signs stable
Case Study 1 - Derek

- One week post PT evaluation:
  - Eyes open 75 – 100 % of session
  - Cervical and lower extremity passive range of motion w/ bilateral lower extremity flexor withdrawal
  - Standing frame 12 minutes, fluctuating vital signs
  - Total assistance bed mobility and transfers
- 2 weeks post PT evaluation:
  - Continue passive range of motion
  - Sitting balance 20 minutes total assistance
  - Standing frame 15 minutes, fluctuating vital signs
  - Total assistance bed mobility and transfers
- 3-4 weeks post PT evaluation:
  - Total assistance bed mobility and transfers
  - Assessed for Tilt in space wheelchair
  - Family/Caregiver training and education
  - E contemplated
- 5-6 weeks post PT evaluation:
  - Complete family/Caregiver training and education
  - Bed mobility & Bed to wheelchair transfers
  - Car transfer
  - Dependent wheelchair carry up and down stairs
  - Letter of medical necessity tilt in space wheelchair and standing frame

Case Study 1 - Derek

- Summary
  - 6 week length of stay
  - Coma recovery scale progressed 3 → 7 out of 23
  - PT decannulated but continued with PEG
  - Total assistance for self care, mobility, and communication/feeding
  - d/c to home with family providing 24 hour care; home care services; tilt in space wheelchair and shower chair
  - Per report continues to be in a vegetative state

Case Study 2 - Alex

- 31 year old male found down from presumed heroin overdose
- Oxygen saturations on room air at 70%
- Received Narcan without improvement
- Rhabdomyolysis; right lower extremity compartment syndrome; fasciotomy
- Past medical history: depression/ anxiety; opioid dependence
- Past social history: independent prior to admission

Case Study 2 - Alex

- Inpatient Brain Injury Rehabilitation
- PEG placement
- Paroxysmal Sympathetic Hyperactivity
- Spasticity and Heterotrophic Oscifacation
- ~4 weeks post event
- 5 week length of stay

Case Study 2 - Alex

- Occupational Therapy:
  - Restlessness and perseverative
  - Decreased orientation
  - Total assistance for self care and transfers on evaluation
  - Decreased sitting balance
  - Flexion withdrawal noted in bilateral upper extremities.

Case Study 2 - Alex

- One week post OT evaluation:
  - Bilateral digit mobilization
  - Total assistant for self care and transfers
  - Improved command following during dressing tasks
  - Reaching and gross grasping tasks
- 2 weeks post OT evaluation:
  - Botulinum injections to bilateral hands
  - Grooming tasks at Maximum assistance level
  - Introduced self feeding at maximum assistance level
  - Emotional liability limiting sessions
- 3-4 weeks post OT evaluation:
  - Self feeding at minimal assistance level
  - With adaptive equipment
  - Simple community integration at wheelchair level
  - Completing fine motor coordination games
  - Family education
- 5 weeks post OT evaluation:
  - Supervision for grooming tasks
  - Maximum to moderate assistance level for stand pivot transfers
  - Decreased mood and affect limit sessions
  - Completing simple ADL tasks at Moderate assistance level
Case Study 2 - Alex

**Speech Therapy**
- Duotube in place on evaluation
- Max cues needed to attend and track visually
- Orally defensive to tootette swab on evaluation
- No oral manipulation or oral prep during PO trials on evaluation

**Physical Therapy:**
- Total assistance for bed mobility and transfers (quad pivot); ambulation and stairs not appropriate on evaluation
- Poor sitting balance = total assistance
- Emotional lability and Decreased orientation
- More active movement seen in left lower extremity greater than right
- Spasticity Right Lower extremity

**5 week length of stay**
- Progressed Rancho 3 → to Rancho 6
- Heterotrophic Oscifacation
- Moderate assistance for transfers and ambulation
- Supervision for eating and word finding deficits
- d/c to SNF and eventually to community
- By report recent overdose and d/c back to community

Case Study 2 - Alex

**3-4 weeks post ST evaluation**
- CLGT
- Attempting to independently self correct language/ word finding errors
- Oriented
- iPad tasks
- 5 weeks post evaluation
- Increased time required to complete tasks
- Sorting/ matching tasks
- Improved recall
- Able to interact with staff while completing tasks

Case Study 2 - Alex

**1 week post evaluation**
- Following one step body centered commands
- Spontaneous speech
- Completing automatic speech tasks
- On full nectar thick liquid diet
- Communicating wants/ needs

**2 weeks post evaluation**
- Right lower extremity passive range of motion.
  - Right knee 30 degrees from full extension/R right knee ratchet orthosis
- Sitting balance 35 minutes moderate to maximal assistance
- Standing frame 25 minutes
- Total assistance bed mobility and transfers
- Ambulation 8 feet assist x 2 and Right knee extension orthosis

**3-4 weeks post evaluation**
- Right lower extremity passive range of motion.
- Sitting balance 30 minutes supervision to minimal assistance
- Maximal assistance bed mobility and transfers
- Ambulation 50 feet maximal assistance
- Moderate assistance bed mobility and transfers
- Ambulation 50 feet minimal assistance
- Bilateral platform wheeled walker

Case Study 3 - Gary

**67 year old male suffered cardiac arrest while in his car resulting in a crash**
- Extraction from car delayed CPR
- CPR initiated for 20 minutes
- Ejection fracture 30-35%
- Past medical history: hypertension; coronary artery disease; gout
- Past social history: insurance company owner; married; independent prior to admission
Case Study 3 - Gary

• Inpatient Brain Injury Rehabilitation
• LifeVest
• ~2 weeks post event
• 5 week length of stay

Case Study 3 - Gary

• Occupational Therapy
  – Decreased orientation
  – Confused/ confabulation
  – Apraxic
  – Total assistance level with self care tasks and transfers

Case Study 3 - Gary

• One week post OT evaluation
  – Total assistance for matching/sorting tasks
  – Poor command following/apraxia
  – Completing simple gross motor tasks
• 2 weeks post OT evaluation
  – Completing simple money management/ coin ID
  – Completing self care tasks with Minimal assistance to maximum assistance
  – Improved attention to tasks up to 40mins in a therapy session
  – Requires increased time and one step cues
• 3-4 weeks post OT evaluation
  – Completing fine motor coordination tasks
  – Minimal assistance for self care tasks
  – Continues to present with apraxia
  – Behavior limiting sessions
  – Mise of objects during self care tasks
  – Minimal assistance for IADL tasks
• 5 weeks post evaluation
  – Continues to demonstrate poor insight into deficits
  – Computer use tasks
  – Decreased safety awareness, memory deficits

Case Study 3 - Gary

• One week post ST evaluation
  – Apraxia of objects during meals
  – Diet upgrade to regular diet with thin liquids
• 2 weeks post ST evaluation
  – Decreased insight and awareness into deficits
  – Behavior limiting sessions
  – 70% accuracy with object naming
  – Family education in regards to POC
• 3-4 weeks post ST evaluation
  – Completing simple-organizational tasks
  – Continues to demonstrate decreased orientation
  – 5 weeks post ST evaluation
  – Continues to complete simple organizational tasks
  – Able to complete social conversation about personal history
  – Unable to provide detailed conversations in regards to goal setting or discharge planning

Case Study 3 - Gary

• Speech Therapy
  – Decreased verbalizations
  – Fatigue/ lethargy limiting evaluation
  – Decreased orientation/ memory/ recall
  – Apraxia of object use noted during swallowing evaluation- DII with thins- orally defensive

Case Study 3 - Gary

• One week post PT evaluation
  – Apraxia of objects during meals
  – Diet upgrade to regular diet with thin liquids
• 2 weeks post PT evaluation
  – Decreased insight and awareness into deficits
  – Behavior limiting sessions
  – 70% accuracy with object naming
  – Family education in regards to POC
• 3-4 weeks post PT evaluation
  – Completing simple-organizational tasks
  – Continues to demonstrate decreased orientation
  – 5 weeks post PT evaluation
  – Continues to complete simple organizational tasks
  – Able to complete social conversation about personal history
  – Unable to provide detailed conversations in regards to goal setting or discharge planning

Case Study 3 - Gary

• Physical Therapy
  – Decreased orientation
  – Confused/ confabulation
  – Low blood pressure
  – Bilateral lower extremity strength against gravity
  – Apraxic
  – Poor sitting balance
  – Bed mobility and transfers total assistance
  – Ambulation and stairs not tested
Case Study 3- Gary

One week post PT evaluation
- Decreased attention
- Vital signs stable
- Bed mobility and transfers moderate to maximal assistance of 1
- Ambulation: wheeled walker 64 feet moderate to maximal assistance of 1

2 weeks post PT evaluation
- Bed mobility and transfers minimal to moderate assistance
- Ambulation: wheeled walker 200 feet minimal to moderate assistance

3-4 weeks post PT evaluation
- Gout flare
- Bed mobility and transfers minimal to moderate assistance
- Ambulation: wheeled walker 5 feet minimal to moderate assistance; antalgic

5 weeks post PT evaluation
- Bed mobility and transfers minimal assist
- Ambulation: wheeled walker 400 feet minimal assist
- Stair negotiation: 12 steps bilateral hand rails (per home setup) minimal assistance
- Completed family care giver education

5 week length of stay
- Progressed from Rancho 4 → Rancho 5
- Minimal assistance level for transfers, ambulation, and self care skills
- Decreased insight into deficits, impulsivity, and decreased memory
- d/c to home with family and 24/7 supervision from Pt’s wife and family
- Per report still presents with decreased insight; independent with self care skills and ambulation; requires supervision for IADL tasks

Other cases
- 60 year old male - drug overdose; myoclonic choreiform movements; limited family support; d/c to SNF
- 35 year old male - drug overdose; spasticity and myoclonic; limited family support; d/c to SNF
- 24 year old male - suicide attempt - strangulation; myoclonic; d/c to home with family
- 28 year old male - aspiration pneumonia; cortical blindness; d/c to home with family
- 43 year old male - cardiac arrest; down for ~20 mins; CPR; myoclonic; d/c home with family
- 44 year old female - drug overdose; brief CPR at scene; flat affect/ severe memory deficits; d/c to home with family

Conclusion
- Multiple causes for anoxic brain injury
- Amount of time a patient is down in the field without care appears to impact recovery
- Recovery from an anoxic brain injury appears longer than a traumatic brain injury
- Regardless of functional level and burden of care, significant family/ caregiver support results in an improved potential for discharge to home

References