Outline

• Definition of Acquired Brain Injury
• Epidemiology
• Brief outline of brain function
• Possible Complications of an ABI
• Possible Visual Consequences of Acquired Brain Injury
• Pathogenesis of Attentional Changes
• Assessment Tools
• Brief Synopsis of Potential Management
What is ABI?

• “Damage to the brain, which occurs after birth and is not related to a congenital or a degenerative disease.”

  WHO Geneva 1996

http://braininjursociety.com/information/acquired-brain-injury/what-is-abi/
• So...what’s the difference between ABI and TBI???
Causes of ABI

• Trauma
• Stroke
• Infections
• Lack of Oxygen (Anoxia)
• Tumours
• Surgery
• Toxic Exposure
FATCS

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• ½ million living with an acquired brain injury
• 18,000 new cases added every year
• 30 times more common than breast cancer and 400 times more common than HIV/AIDS.

The OBIA Impact Report 2012
https://www.ontario.ca/img/ontario@2x-print.png
• 1.5 million living with an acquired brain injury
• 160,000 new cases each year
Brain Anatomy and Function

http://ichef-1.bbci.co.uk/news/624/media/images/71876000/jpg/_71876007_c0177401-brain_activity_artwork-spl.jpg
Frontal Lobe

- Emotional control
- Creativity
- Motivation
- Judgement/ Decision making
- Problem solving
- Movement/ motor function
- Some speech [link](http://braininjuryassociation.com/information/acquired-brain-injury/understanding-the-brain/)
- Social behaviour

Parietal Lobe

- Visual attention/ Spacial Relationships/Integration of Senses
- Touch
- Directed voluntary movements
- Manipulating of objects

Temporal Lobe

- Hearing
- Memory
- Identifying, describing, categorization of objects
- Understanding language
Occipital Lobe

- Vision.....
Cerebellum

• Balance
• Coordination
Brainstem

- Breathing
- Heart Rate
- ANS - Controls sweating, blood pressure, temperature
- Sleep/wake cycles

https://upload.wikimedia.org/wikipedia/commons/6/69/1311_Brain_Stem.jpg
The table lists the lobes of the brain and their normal functions as well as problems that may occur when injured. While an injury may occur in a specific area, it is important to understand that the brain functions as a whole by interrelating its component parts.

### Table: Healthy Brain vs. Injured Brain

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Healthy Brain</th>
<th>Injured Brain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frontal lobe</strong></td>
<td>Personality / emotions, intelligence, attention / concentration, judgment, body movement, problem solving, speech (speak &amp; write)</td>
<td>Loss of movement (paralysis), repetition of a single thought, unable to focus on a task, mood swings, irritability, impulsiveness, changes in social behavior and personality, difficulty with problem solving, difficulty with language, can't get the words out (aphasia)</td>
</tr>
<tr>
<td><strong>Parietal lobe</strong></td>
<td>Sense of touch, pain and temperature, distinguishing size, shape and color, spatial perception</td>
<td>Difficulty distinguishing left from right, lack of awareness or neglect of certain body parts, difficulties with eye-hand coordination, problems with reading, writing, naming, difficulty with mathematics</td>
</tr>
<tr>
<td><strong>Occipital lobe</strong></td>
<td>Vision</td>
<td>Defects in vision or blind spots, blurred vision, visual illusions / hallucinations, difficulty reading and writing</td>
</tr>
<tr>
<td><strong>Temporal lobe</strong></td>
<td>Speech (understanding language), memory, hearing, sequencing, organization</td>
<td>Difficulty understanding language and speaking (aphasia), difficulty recognizing faces, difficulty identifying / naming objects, problems with short- and long-term memory, changes in sexual behavior, increased aggressive behavior</td>
</tr>
<tr>
<td><strong>Cerebellum</strong></td>
<td>Balance, coordination</td>
<td>Difficulty coordinating fine movements, difficulty walking, tremors, dizziness (vertigo), slurred speech</td>
</tr>
<tr>
<td><strong>Brainstem</strong></td>
<td>Breathing, heart rate, alertness / consciousness</td>
<td>Changes in breathing, difficulty swallowing food and water, problems with balance and movement, dizziness and nausea (vertigo)</td>
</tr>
</tbody>
</table>
The Way Your Brain Is Organised

LEFT HEMISPHERE
LINEAR THINKING MODE

RIGHT HEMISPHERE
HOLISTIC THINKING MODE

Writing
Language
Scientific skills
Mathematics
Lists
Logic

Emotional expression
Spatial awareness
Music
Creativity
IMAGINATION
Dimension
Gestalt (whole picture)

Right hand control
Left hand control

IMPACT OF ABI


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Cognitive Impairment

- Memory loss/ poor memory
- Information overload
- Difficulty with planning, decision making
- Confusion
- Difficulty understanding language
Motor, Sensory and Autonomic Impairment

- Fatigue/ disturbed sleep
- Weakness/paralysis – mainly on one side
- Pain
- Difficulties with balance, coordination
- Difficulties with speech (aphasia)
- Visual impairments and other sensory impairments
Emotional and Behavioural Difficulties

• Irritability/Anger- ‘short fuse’
• Depression/Anxiety
• Decreased confidence
• Loss of self
• Lability
• Impulsivity
• Low motivation
Leading to....
Lifestyle Changes

- Loss of self
- Loss of privacy/independence
- Isolation
- Change/loss of relationships
- Changing roles
- Loss of income
- Future???

http://braininjursociety.com/information/acquired-brain-injury/what-is-abi/
http://biad.ca/about-brain-injury/
Possible Visual Consequences of ABI
• 26% of those with ABI reported trouble with their vision most of the time…
Following a neurological event…

• Typical visual symptoms following a brain injury include:
  – Blur (sometimes intermittent)
  – Double vision
  – Difficulty tracking
  – Trouble focusing
  – Glare sensitivity and photophobia
• May also report:
  
  – Eye strain/fatigue
  – Headaches
  – Slow visuomotor performance
  – Difficulties with balance and posture

Loss of Visual Function

• Decreased acuity
  – Often increase in myopia
  – NB importance of good refraction!
• Decreased contrast sensitivity

Oculomotor control and accommodation

- Accommodative dysfunction
- Vergence issues/misalignment
- Version abnormalities
TBI vs CVA

• TBI: more likely to have a higher occurrence of accommodative insufficiency and near strabismus

• CVA: more likely to have a higher occurrence of accommodative infacility?? and distance strabismus
• Both more likely to demonstrate deficits of saccades, convergence insufficiency and CN III palsy.

Visual Field Defects

• Scattered defects account for the most followed by homonymous VF defects

http://www.perkinselearning.org/videos/webcast/visual-fields
Attentional/ Perceptual Changes

• Neglect
• Extinction
• Visual Midline Shift Syndrome
Neglect

• aka Unilateral Spatial Inattention
• Unawareness of one side of visual space
  – Personal
  – Peripersonal
  – Extrapersonal

Extinction

- Different from neglect??
- Selective impairment in awareness/response to a stimulus when presented simultaneously on both sides

Visual Midline Shift Syndrome (VMSS)

• aka Abnormal Egocentric Localization (AEL)

• Deviated perception of visual midline
  – Poor eye/hand coordination
  – Postural changes
  – Diminished ability to navigate environment

Pathogenesis of Attentional Changes
Neglect

http://www.floiminter.net/psychology/brain_and_behaviour/dorsal_ventral.png
Extinction
Visual pathways....
Assessment Tools
Refraction

- May need to consider trial frame refraction
Contrast Sensitivity

http://www.psych.nyu.edu/pelli/pellirobson/pelli-robson.gif

http://www.marsperceptrix.com/sites/marsperceptrix.com/files/styles/uc_product_full/public/MLCS_T%20black%20and%20white%20402%20x%20224_0.png?itok=8L9P8z2W

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<table>
<thead>
<tr>
<th>Condition</th>
<th>Value Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&gt;1.65</td>
</tr>
<tr>
<td>Mild loss</td>
<td>1.30-1.60</td>
</tr>
<tr>
<td>Moderate loss</td>
<td>0.95-1.25</td>
</tr>
<tr>
<td>Severe loss</td>
<td>0.60-0.90</td>
</tr>
<tr>
<td>Profound loss</td>
<td>0.25-0.55</td>
</tr>
</tbody>
</table>
Oculomotor control/accommodation

Stay Tuned. Coming Soon!

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Visual Fields
Neglect

Line Bisection

Copying Tasks

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Extinction

https://www.clicktocurecancer.info/optic-nerve/images/2129_16_31-eye-schematic-confrontation-test.jpg
VMSS

VISUAL MIDLINE SHIFT TEST

Visual Midline Shift To Right
Synopsis Management Options

• Proper Spectacle Prescription!
• Filters
• Vision Therapy
• Yoked prisms
• Magnification?
• Field Enhancement
  – Orientation and Mobility Training
Field Enhancement

Image courtesy of Eli Peli

http://archopht.jamanetwork.com/data/journal/s/ophth/6878/s_ecs70078f4.png
Patient Education

• Expectations
• And also…
  – Contrast
  – Lighting
  – Uncluttered environment
  – Consistency
Adapting your assessment
Physical Environment

• Ensure office is accessible
• Contrast optimal, lighting even
• Uncluttered pathways
  – Practise what we preach!
• Leave enough time for assessment
• If possible, schedule towards end of day
  – Less commotion in office
• May need multiple visits in order to complete assessments
• Be prepared to adjust assessment for physical impairments and communication impairments

• Be aware of possible visual sequelae and test appropriately
• Counsel on expectations
• Include family/friends if permitted
• Collaborate with other health professionals within patients circle of care
Thank You!

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Resources for patients

- http://obia.ca/
- http://www.abinetwork.ca/
- http://www.biaww.com/
References


Other reading..

- *Brain Injury* 2 (3) – special issue on Neuro-Optometry