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Concussion and the Older Adult
Does Age Make a Difference?

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## Objectives

<table>
<thead>
<tr>
<th>Identify</th>
<th>5 components of subjective and objective exam for the older adult with concussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify</td>
<td>3 elements unique to the intervention and management of the older adult with concussion</td>
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<tr>
<td>Identify</td>
<td>2 factors relative to prognosis of the older adult with concussion</td>
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<tr>
<td>Identify</td>
<td>3 areas of gaps in the literature on mTBI in the older adult</td>
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## Overview of mTBI in Older Adult

- Epidemiology
- Diagnosis
- Comorbidities
- Health Care Utilization
Epidemiology: Growing Problem

- TBI's per year for > 65 years: over 200,000
- Burden On Emergency Departments
- Causes Range
  - 60% Falls
  - 8% MVA
  - 6% Struck by object
  - 1% Assaults
  - 25% Unknown

Papa et al 2012; Faul et al 2010

Epidemiology: Growing Problem

- Incidence
- Limitations in the Literature
  - Many incidents go unreported

Diagnosis

- Typical Classification of TBI - Glasgow Coma Scale
- CT Scan
- Anticoagulant Use: increased risk of intracranial bleeding

Freire-Aragon et al; Papa et al 2012

Diagnosis: CT Scan

- Canadian CT Head Rule, any 1 of the following
  - High Risk Factors
  - Medium Risk Factors
- Limitation: Elderly fit into the high risk factor just because of age

Stein et al 2001
Diagnosis: Biomarkers

- S100B Protein
- May Reduce CT scan Costs
- Limitations for the Elderly

Biberthaler et al 2006; Freire-Aragon et al 2017

Comorbidities

- Elderly vs. Young
- HTN
- Alcoholism
- Diabetes, Arrhythmias, COPD
- Neurodegenerative Disorders

Mosenthal et al 2004; Thompson et al 2012
Health Care Utilization

- Costs for TBI in the US as whole
- Annual Treatment Costs: about $76,000
- Focus is on Cutting Costs
- Opportunities


Assessment - Multisystem Approach

- Overwhelming
  - Lack of Management
  - Multiple Areas of Assessment
- Streamlined Exam for Young but Not for Elderly
- Typical Scenario for mTBI in elderly
Subjective Exam: Health History

- You might be the First
- Mortality
- Important Areas to Screen

Papa 2012; Thompson et al 2012

Subjective Exam: Medications

- Anticoagulants
- Anti-hypertensives
- Psychotropics
Subjective Exam: Injury/Fall History

- Risk of Returning to ED
- Multiple Head Injuries
- Components of fall – identify trends

Southerland et al 2016; Yee et al 2017

Subjective Exam: General Systems Screening

- Respiratory
- Autonomic
- Cardiac
- Mental Status
Subjective Exam: Mental Status

- Depression
- Cognition
  - Mini Mental
  - Mini Cog
  - AD8 Dementia Screening

Matuszak et al 2016; Yesavage et al; Ozen et al 2015

Self Report Measure:
Post Concussion Symptom Scale

- Headache
- Pressure in Head
- Neck Pain
- Nausea and Vomiting
- Balance Problems
- Dizziness
- Noise Sensitivity
- Feeling Slowed Down
- Don’t feel right
- Sensitivity to Light
- Visual Disturbances
- Fatigue
- Trouble Falling Asleep
- Drowsiness
- Irritability
- Sadness
- Nervousness
- Feeling more Emotional
- Feeling Foggy
- Difficulty Concentrating
- Difficulty Remembering
- Confusion

Lovell et al 2006; Chen et al 2007
Subjective Exam:
Self Report Measures

- Activities Specific Balance Confidence Scale
- Dizziness Handicap Inventory
- Headache Disability Inventory
- Neck Disability Index

Rehabmeasures.org; Jacobson et al 1994

Multisystem Approach:

Risk Factors → Concussion → Clinical Trajectories → Treatment Pathways

- Vestibular
- Ocular
- Cognitive
- Migraine
- Anxiety/Mood
- Cervical

Risk Factors:
- Previous Concussions
- Migraine
- ADHD
- Sex
- Age
- Motion Sensitivity, Ocular History

Treatment Pathways:
- Physical Rehab
- Speech/Cognitive Therapy
- Psychologic Treatment

Collins et al 2013
Multisystem Approach:

Risk Factors → Concussion → Clinical Trajectories → Treatment Pathways

- Previous Concussions
- Fall Risk
- Co-morbidities
- Sex
- Age
- Anticoagulants

Clinical Trajectories:
- Vestibular
- Ocular
- Migraine
- Cervical
- Cognitive
- Anxiety/Mood

Treatment Pathways:
- Physical Rehab
- Speech/Cognitive Therapy
- Psychologic Treatment

Post Concussion Symptom Scale

- Headache
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- Confusion
Musculoskeletal System: Upper Quarter

- Migraine and Cervical Clinical Trajectories
- ROM/Strength & Recruitment patterns
- Assess joint mobility
- Posture
- Proprioception: JPE and SPNTT

Schneider et al 2014; Morin et al 2016

Joint Position Error Test

- Measuring Cervical Afferents
- Patient stands 90 cm from target with head lamp, adjusted to the center of the target. Patient closes eyes and turns head in 1 direction and returns head to the middle. Measure how far patient is from target after return to the center

Treleaven et al 2006
Joint Position Error Test

http://www.skillworks.biz/news/520810

Smooth Pursuit Neck Torsion Test

Treleaven et al 2006
Musculoskeletal System: Lower Quarter

Ataxia or Vestibular Clinical Trajectory
Strength/ROM
Sensation
Pain
Gait

Vestibular Assessment

- Vestibular and Ocular Trajectories
- Peripheral and Central Injuries
- VOMS
- BPPV

Mucha et al 2014; Sogebi et al 2014
# VOMS

<table>
<thead>
<tr>
<th>Vestibular Oculomotor Test</th>
<th>Not Tested</th>
<th>Headache 0-10</th>
<th>Dizziness 0-10</th>
<th>Nausea 0-10</th>
<th>Fogginess 0-10</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Baseline Symptoms</td>
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<tr>
<td>Smooth Pursuits</td>
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<tr>
<td>Saccades - Horizontal</td>
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<tr>
<td>Saccades - Vertical</td>
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<td>Convergence Near Point</td>
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<td>VOR - Horizontal</td>
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<tr>
<td>VOR - Vertical</td>
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<tr>
<td>Visual Motion Sensitivity Test</td>
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</tbody>
</table>

Mucha 2014

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**Convergence**

**Smooth Pursuit**
VOMS

Horizontal Saccades

Vertical Saccades

VOMS

Horizontal & Vertical VOR

Visual Motion Sensitivity
Vestibular Assessment: Positional Testing for BPPV

- Common cause of dizziness in elderly
- 30% of mTBI cases
- Displaced Otoconia
- “Spinning Sensation”

Haffer et al 2004; Ogahalia et al 2000

BPPV treatment

- Consider Position Adjustment
- BPPV First
- Test All Canals
Vision and Oculomotor Function

- Ocular, Migraine, & Vestibular Trajectories
- Blurred vision, Light Sensitivity and Diplopia
- Oculomotor Impairments that can occur
- Complete Components of VOMS

Capo-Aponte 2012

Misalignment: Cover Test

- Wear corrective lens
- Head straight
- Remove the cover, look for any refixation movements. Repeat
Misalignment: Cover Uncover Test

- Same Parameter as Cover Test
- Attention is now on the covered eye
- Look for any refixation movements of that eye. Repeat

Saccades: King-Devick Test

- Assess saccade function
- Read each card out loud
- Note Increase in Symptoms
- Research
Coordination & Balance Reactions

- Ataxia & Vestibular Trajectories
- Rapid Alternating Movements
- Berg Balance Test
- Dynamic Gait Index
- Functional Gait Assessment
- Instrumented Tests

Rehabmeasures.org ; Hoffer et al 2009

Sensorimotor Processing

SOT
mCTSIB
Autonomic System

- Buffalo Concussion Treadmill Test
  - Treadmill testing in elderly mTBI has not been studied
  - Adapt to fit the functional ability of the population
- Test for Orthostatic Hypotension
- Complaints of temperature changes

Leddy et al 2013

Referrals & Recommendations

- Ocular • Neuro Optometry
- Migraine • Neuro Optometry • Neurology
- Cervical • Recommending Open Mouth X-Rays
- Vestibular • Neurology or ENT
- Cognitive • Speech • Neuropsychology
- Anxiety/Mood • Neuropsychology • Gerontology
- Ataxia • Neurology
Interventions:
- Vestibular
- Ocular
- Cognitive
- Migraine
- Anxiety/Mood
- Cervical

Clinical Trajectories ➔ Treatment Pathways
- Physical Rehab
- Speech/Cognitive Therapy
- Psychologic Treatment

Vestibular

- Symptom Management
- Habituation Activities
- VOR Exercises
Vestibular Exercises

Oculomotor

Smooth Pursuit
• Use 2 decks of cards, one is face up on the wall and one is in the hand

Saccades
• Saccades between 2 targets

Convergence
• Pencil Push Ups
• Brock String
Oculomotor Exercises

Pencil Push Ups
Brock String

Sensory Re-Weighting
Cervical & Postural Interventions

- Chin Tuck to target deep neck flexors without pulling in accessory muscles
- Chin Tuck with head movement and Head Lamp
- Exercises to improve scapular stabilization and mobility

Migraine Management

- Identify Triggers
- Postural Education
- Referral to Optometry
- Track Symptoms
Exertional

- Walking program
- Treadmill program
- Consider Assistive Device

Cognitive Issues

- Consider Neuro-psychology testing
- Speech Therapy Referral
- Discuss Safety
- Geriatrician
- Repeat Falls that occur during the plan of care
Outcomes: Elderly TBI vs Younger

- Functional Outcomes
- Discharge Disposition
- Less likely to return to work or live independently
- Overall Psychosocial Outcomes: 60% vs 20%
- Glasgow Comma Scale as a Predictor

LeBlanc 2006; Rothweiler 1998

Outcomes for elderly mTBI

- Depends on definition of outcome
- Cognitive performance
- Variability in Literature

Deb 1998; Goldstein 1994; Mosenthal 2004
Case Examples

PATIENT A – 68 YR OLD FEMALE

Patient A

- 68 year old female
- Initial complaint: frequent falls
- Referred initially by Kinesiologist and then had her ENT write a referral
- C/O falling 1 time per month, with frequent near falls throughout the day
- Falling began occurring after eye surgery in 2014 for vision changes and eye issues

- Upon Interview:
  - Falls with blows to head 4 times in 2 years – most recent 3 months prior
  - Falls occur in visually challenging environments
  - She has hit posteriorly 1 time, anteriorly 3 times
  - Since the last head impact she reports
    - Dizziness
    - Worsening Balance
    - Fatigue
Patient A

- PMHX
  - OA lumbar spine
  - Neuropathy
  - Hypothyroidism
  - Glaucoma and Visual Changes
- Medications
  - Synthoid and duloxetine
- Imaging
  - MRI 3 yrs ago shows “abnormal spot in the back of my brain”
  - Denies Neck Pain
  - Depression Controlled
  - Denies worsening visual changes since head injuries
  - Denies changes in Cognition
  - Uses a cane occasionally
  - Drinks a glass of wine occasionally
  - She is married, husband has early signs of dementia and she has limited support of her children

Patient A

- Mini Mental 30/30
- Vitals: negative for orthostasis
- ABC: 53%
- DHI: 34/100
- Post Concussion Symptom Scale
  - Score 22/132
  - Balance, Dizziness, Fogginess, Fatigue
Interventions:

- Vestibular
- Ocular
- Cognitive
- Ataxia
- Anxiety/Mood
- Cervical

Clinical Trajectories

Treatment Pathways

- Physical Rehab
- Speech/Cognitive Therapy
- Psychologic Treatment

Patient A

- Education
- FGA: 17/30
- Strength/Sensation: 4/5 hip and Vibration Intact
- Cervical Spine: clear
- VOMS: Score 14; Convergence 10 cm
- VORcx, Head Thrust, DVA normal
Patient A

- Treadmill Testing: Unremarkable
- Sensory Organization Testing

Patient A: problem list

- Impaired strength LE
- Fall Risk
- Movement Quality was poor with delayed balance reactions, premature reaching
- Convergence was abnormal
Patient A: Interventions

- Referral to Neurologist
- Sensory Re-Weighting Exercises
- Vestibular Exercises
  - VOR exercises
  - Pencil Push Ups
- Balance Reaction Training

Patient A: Outcomes

![Graph showing outcomes for Patient A]
Case Examples

PATIENT B – 77 YR OLD FEMALE

Patient B

- 77 year old female
- Initial complaint: Dizziness
- Referred by ENT
- C/O falling 3 times per year
- Reports history of 4 concussions with most recent 3 months ago. Diagnosed with Subdural Hematoma.
- Daughter reports cognitive changes recently
- Has seen P.T. for neck and back pain after previous falls
- Dizziness Description
  - Typically 3/10
  - Worst 9/10
  - No complaints of spinning
  - Denies visual changes
  - Sometimes has headaches
Patient B

► PMHX
  ► HTN
  ► Seizures
  ► Hypothyroidism
  ► Osteoporosis
  ► Incontinence
  ► Right TKR
  ► A-fib
► Imaging
  ► MRI small vessel ischemic changes
► Medications
  ► Vitamins and Supplements
  ► Levothyroxine
  ► Digoxin
  ► Donepezil
  ► Tolterodine Tartrate
  ► Warfarin
  ► Fentanyl Patch
  ► Depression Controlled
  ► No assistive device
  ► Lives with Daughter

Patient B

► Mini Mental 22/30
► Vitals: negative for orthostasis
► ABC: 30%
► DHI: 36/100
► Post Concussion Symptom Scale
  ► Score 28/132
  ► Headach, Trouble Sleeping, Memory
Interventions:

Clinical Trajectories

- Vestibular
- Ocular
- Cognitive
- Migraine
- Anxiety/Mood
- Cervical

Treatment Pathways

- Physical Rehab
- Speech/Cognitive Therapy
- Psychologic Treatment

Patient B

- Education: Safety & Neuro-Cog Testing
- FGA: 15/30
- VOMS: Score 29; Convergence 10 cm
  - Diplopia with Smooth Pursuit
- Dynamic Visual Acuity Test: 5 line degradation
- Positive Right Head Impulse test
- Negative for BPPV
Patient B

- Treadmill Testing: Unremarkable
- Cervical
- Sensory Organization Testing

Patient B: problem list

- Impaired VOR
- Fall Risk
- Motion Sensitivity
- Convergence was abnormal
- Impaired Oculomotor Function: Diplopia with Smooth Pursuits
- Cognitive Changes
Patient B: Interventions

- Referrals
- Vestibular Exercises
- Oculomotor Exercises
  - Pencil Push Ups
  - Balance Reaction Training

Symptoms of Headache and Dizziness Fluctuated day to day

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Patient B

- Function
- FGA: 15/30 → 17/30
- ABC: 30% → 53%
- VOMS: Unchanged
- Limitations:
  - Oculomotor, Co-morbidities, Cognition


