Montreal Cognitive Assessment (MoCA) as Screening tool for cognitive impairment in mTBI.

DOC, DO I HAVE A BRAIN INJURY?

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My Patient

- 3 yrs ago 31 yrs old  base/soft ball coach middle school, In party got sucked in to football game with college students.
- She had head to head impact with transient loss of awareness, mild dizziness confusion immediately and nausea 2 days
- Referred to my clinic for daily headaches & fogginess of brain with normal MRI brain
- MoCA Score 25/30, She asked me question lead to this research “Doc Do I Have Brain Injury?”
My Patient MoCA Score

Montreal Cognitive Assessment (MoCA)
Version 7.1 Original Version

Visuospatial/Executive

Naming

Memory

Attention

Language

Abstraction

Delayed Recall

Orientation

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Normal: 26/30
Total: 26/30
MoCA

- Montreal Cognitive Assessment
- Devised by Nasreddine et al in 2005 as a quick screening tool to detect cognitive impairment
- Validated for dementia, Alzheimer’s disease, Parkinson’s disease and Vascular encephalopathy
- Proven to be effective in sensitivity and specificity for detecting cognitive impairment
MoCA

- MoCA assesses 8 neurocognitive domains
  - Visuo-spatial / Executive Functioning
  - Naming
  - Memory
  - Attention
  - Language
  - Abstraction
  - Delayed Recall
  - Orientation
Burden of TBI / mild TBI

- **USA**
  - About 1.7 million TBI/year in the US
  - 75% (1.3 million) are diagnosed to have mild TBI- they are treated and released from the ER without any specific follow-up instructions
  - In addition to the human toll, MTBI costs the US $17 billion each year

- **Canada**
  - Annual incidence of severe TBI is 11.4 per 100,000
  - Mild TBI 600 per 100,000.
  - Injury costs to **Canadians** close to $20 billion
mTBI

- According to a recently published data by the CDC, approximately 40% of mTBI patients have at least one unmet need / with problem even after one year of injury.

- The top three unmet needs were:
  - Improving memory and problem solving
  - Managing stress and emotional upsets
  - Improving vocational skills at pre injury level

All the above needs are related to the neurocognitive impairment
mTBI: CDC definition

- Injury to the head resulting in one or more of the following:
  - Transient confusion, disorientation or LOC
  - Dysfunction of memory around the time of injury
  - LOC < 30 minutes
  - Observed signs of neurological or neuropsychological dysfunction with normal radiological studies.
mTBI: ER or Urgent Care

- Most ER physicians will focus on vital sign maintenance and rule out major brain trauma by clinical and radiological investigation (CT scans)
- If no abnormality is found: Majority patients are released with instructions to watch for warning signs
- Most of the times, no follow-up instructions or any support system are provided
mTBI: Ideal Approach

- Emergent: The standard ER protocol
- Follow-up Ideal Protocol:
  - Persistent symptoms after 2 weeks treatment and evaluation
  - Assessment of cognitive functioning
  - Emotional and behavioral status assessment
  - Speech pathologist assessment
  - Planning and execution of rehab regime, if necessary
  - 3-6 months post injury: Thorough evaluation to assess and document the recovery and rehabilitation

Unfortunately, no practice guidelines are available for the follow-up evaluation, treatment and rehabilitation of MTBI patients.
Our Facility

- **Comprehensive Outpatient Mild Traumatic Brain Injury & Cognitive Brain Training Center**
- The only neurocognitive rehabilitation outpatient center in Louisiana and or USA.
- The only urgent headache treatment center in the Louisiana operated by neurologist
- We had the unique opportunity to assess mTBI patients who came to us with the most common symptoms: **Headache and Vertigo lead to research publication.**
- "Post concussion syndrome & BPPV presenting with migraine/headaches in an urgent headache clinic: Analysis of 90 cases, S. Kumar MD ~poster presentation. 2014 annual meeting of American Headache Society. Los Angeles, CA
Objective

To study MoCA as effective screening tool in mTBI patients or concussion head injury and to study neurocognitive type injury in mTBI with 8 cognitive module of MoCA.
Patients selection

- In the past 2 years we evaluated 115 adult patients with mild traumatic brain injury presenting to our facility.
- Time period elapsed between injury and presentation ranged from 0.5-84 months.
- We decided to exclude the patients who had presented to us for the first time after >36 months post injury (n = 22).
Patients Demographics

- Remaining 93 patients were included in this analysis
- 48 (51%) were males and 45 females
- Age range: 21-72 years (mean 43 years)
- Presenting symptoms Headache (n = 80) and Vertigo (n = 45) most common symptoms
- Only 20 patients (21.5%) had a subjective symptom associated with cognitive impairment (memory loss, problem solving difficulty, problem focusing etc.)
Methods

- In addition to standard clinical and neurological assessment, we administer MoCA to all patients as a part of the initial work-up.
- The test is administered by a trained staff personnel as per the guidelines in a private room with no distractions.
- Patients with severe emergent symptoms like headache and/or nausea are stabilized prior to the test.
- Each patient is specifically asked about subjective symptoms of cognitive impairment.
Methods

- Complete and comprehensive documentation is maintained for every patient.
- The MoCA score of every patient was analyzed for composite scores as well as individual module scores.
- After deliberation, a composite score lower than 27/30 points was considered indicative of post TBI cognitive impairment.
Methods

- Logic behind score consideration (≤ 27):
  - The original recommendation by Nasreddine et al was to consider 26 and below as abnormal, however it focused on patients with dementia
  - MTBI patients generally demonstrate a higher cognitive ability than the patients of dementia
  - Additionally MTBI patients DO NOT generally have impairment of “orientation” ability (6 points) that is commonly found in dementia
Specific aims of the analysis

- To assess the sensitivity and specificity of MoCA scores in identifying neurocognitive impairment in patients of MTBI and/or post concussion syndrome (PCS)
- To possibly identify individual neurocognitive modules of the test that were most frequently impaired in MTBI/PCS patients
Analysis

- Since all patients had established history of mTBI / concussion within the past 1-36 months, the possibility of “false positive” did not exist. Hence the sensitivity of MoCA was assessed based upon true positive and false negative results.

- For individual cognitive modules identification, any imperfect score was considered abnormal.
Results: Composite score

- The composite MoCA score was abnormal (≤ 27/30) in 74 patients.
- The sensitivity of MoCA in detecting the presence of neurocognitive impairment in MTBI patients in 79.5%
- The scores between 21-24 were most frequently noticed (44%) moderate followed by 25-27 (39%) mild and ≤ 20 (17%) severe.
- Thus in the current analysis two thirds (66.6%) of the mTBI patients population had MoCA scores between 21 and 27 points mild to moderate cognitive deficit.
Percentage of TBI population in the score group

17% Sever 0-20, 44% moderate 21-24, 39% Mild 25-27
Results: Individual scores

<table>
<thead>
<tr>
<th>MODULE</th>
<th># ABNORMAL</th>
<th>SENSITIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISUOSPATIAL/ EXECUTIVE</td>
<td>61</td>
<td>65.5%</td>
</tr>
<tr>
<td>DELAYED RECALL</td>
<td>75</td>
<td>80.6%</td>
</tr>
<tr>
<td>ATTENTION</td>
<td>52</td>
<td>55.9%</td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>46</td>
<td>49.4%</td>
</tr>
<tr>
<td>NAMING</td>
<td>10</td>
<td>10.7%</td>
</tr>
<tr>
<td>ABSTRACTION</td>
<td>4</td>
<td>0.04%</td>
</tr>
<tr>
<td>ORIENTATION</td>
<td>4</td>
<td>0.04%</td>
</tr>
</tbody>
</table>

Considering the above results, it is obvious that the first four modules, namely Visuospatial, Delayed recall, Attention and Language together are the most commonly affected cognitive functions in patients with MTBI.
Percentage population with abnormal score

- Visuospatial/Executive
- Delayed Recall
- Attention
- Language
- Naming
- Abstraction
- Orientation

Percentage population with abnormal score
Results: >1 year after injury

- 16/93 patients presented to us ≥ 1 year after their initial injury
- None of the patients were aware subjectively of the cognitive losses
- 12 patients (75%) were found to have MoCA scores < 27 and upon questioning, admitted to have memory loss.
Conclusion

- Assessment of cognitive impairment should be a mandatory protocol while evaluating patients of mTBI.
- Cognitive impairment persists in majority (75%) of patients even a year after mTBI.
- MoCA is a quick and reasonably sensitive (80%) test for cognitive impairment following mTBI.
- Majority of the patients (67%) with mTBI will demonstrate a composite MoCA score between 21 and 27.
- The modules of Visuospatial, Delayed recall, Attention and Language are the most commonly impaired cognitive functions in patients with MTBI.
Recommendations

- Mandatory 2 week and 3 month follow up after mTBI with Trained physician in TBI
- Routine screening of mTBI patients with MoCA.
- MoCA can be further simplified for spot screening tool may need further study
- MoCA also effective tool for Stratify the treatment plan for MTBI patients needs further studies.
- We are studying MoCA to further validate with Std WASI IV and NAB battery neuropsychology test
My patient

- After 3 years of research . . . . . .
- I have an answer to my patient

- Yes She has had Mild TBI on Neuro-Clinical exam & on MoCA Screening on initial visit.
Susceptibility image

Hemosiderin deposits in frontal poles: hemosiderin is a byproduct of blood and points to old hemorrhage. Frontal poles are generally involved in trauma when the frontal lobe hits the frontal bone.
Cortical integrity

3D reconstruction of the patient's cortex. Red shows normal thickness. Blue indicates damage to cortical integrity.
Cortical integrity

3D reconstruction of the patient's cortex. Red shows normal thickness. Blue indicates damage to cortical integrity.
Corpus callosum

Gap in the corpus callosum
Missing fibers in the corpus callosum
THANK YOU

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