Dr. Paul Comper

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Dr. Paul Comper is a clinical neuropsychologist at the Toronto Rehabilitation Institute – University Health Network, where he has worked with the ABI clinical team since 1997. Dr. Comper also holds faculty appointments at the University of Toronto in the Faculty of Kinesiology and Physical Education, the Rehabilitation Sciences Institute (Faculty of Medicine), the Collaborative Program in Neuroscience and the Psychological Clinical Science program at University of Toronto, Scarborough. He is also the consultant neuropsychologist with the David L. MacIntosh Sports Medicine Clinic at the University of Toronto.

Paul has published and presented internationally in the area of mild traumatic brain injury and sports related traumatic brain injury (i.e., concussion) – with more than 100 peer reviewed publications and podium presentations in the past decade. For the past 15 years Dr. Comper has been the neuropsychology consultant to the National Hockey League Players' Association (NHLPA) and is the Co-Chair of the joint NHL/PA Concussion Subcommittee.

ACQUIRED BRAIN INJURY ACROSS THE AGES

Understanding the Neuropsychological Assessment & How to Apply it to Your Patients and Your Practice

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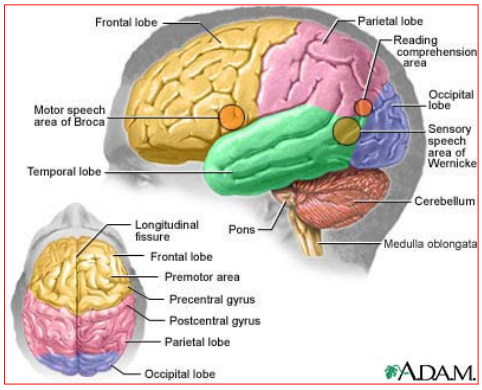
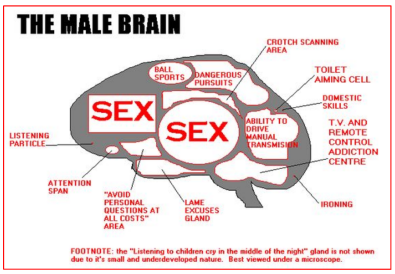
Today's Outline

1. Two minute brain tour
2. Clinical Neuropsychology ('NP') 101
3. Interpreting the NP results
4. Pros and Cons of the NP assessment
5. Red Flags
6. Other issues/FAQ

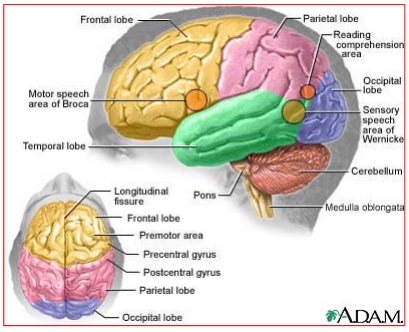
1. Two Minute Brain Tour

The Brain





Main Structural Components:
Front to Back



- Frontal lobes- motor planning, motor movement, *executive functions*, personality
- Motor 'strip'
- Sensory 'strip'
- Temporal lobes – auditory perception, memory
- Parietal lobes – interpreting sensory input
- Occipital lobes - vision

Left to Right – 2 Hemispheres

Left – Primarily Verbal

- Language
  - Expressive (motor speech)
  - Receptive
  - Verbal Memory
- Calculations
- Sequential Reasoning
- Motor/sensory control of contralateral side

Right – Primarily Non Verbal

- Spatial coordinates; drawing
  Non-verbal memory
- Color discrimination
- Performing automatic functions
- General depth perception
- Spatial reasoning
- Constructional functions (one of the most frequent RH disorders results in constructional dyspraxia)
- Ability to recognize faces
- Motor/Sensory control of contralateral side

Injury to the Brain May Result in:

- Impairment to one or more areas or functional systems, e.g.,
  - Partial or complete inability to speak if 'stroke' occurs in the left frontal lobe;
  - Poor planning, poor decision making if bilateral-frontal trauma
  - Memory impairment

...or no discernible impairment at all!

2. Neuropsychology Basics

Why a neuropsychological assessment?

1. To provide or assist in provision of a diagnosis or differential diagnosis
2. To assist with patient care and planning
3. To implement treatment and remediation
4. To evaluate a treatment program or intervention
5. To answer research questions
6. To address forensic (court related) issues

When to make a referral for NP

- Based on the magnitude of injury
  - e.g., GCS<12 for more than a day
  - Admission to NICU for >1 day
  - Any neurosurgical intervention post-TBI
  - Admission to ABI inpatient program
- If there are concerns about pre- post- TBI cognitive, mood or behavioural disruption
- As an 'all clear' prior to RTW or school
- Not before 3 to 6 months post moderate to severe TBI

Helpful to specify the referral question!

Patient 1

- 32 yr. old female, university educated
- Severe TBI compounded by bilateral ICA dissections
- In LTC for 18 months
- Verbal apraxia, dense right hemiplegia – 'locked in'
- No facial expression
- 2-person assist
- Deemed incapable of making personal decisions

- NP Ax conducted over 6 months at 2-week intervals
  - Highly intelligent
  - Excellent memory
  - Good sense of humour
  - Expressed frustration… "things are not as they seem to others"
  - Able to run a business

Subsequently deemed competent to make decisions about personal care

Patient 2

- 22 yr. old male - MVA
- Severe TBI with coma, PTA, lengthy inpatient ABI admission; documented lesions on CT and MR scans
- Seen at 4 months post-injury
  - Somewhat disinhibited
  - No motor or cognitive issues apparent
  - No reported behavioural issues by others

- Severe cognitive impairment demonstrated 'across the board' on all objective measures, consistent with the nature and severity (and expectation) of the incident
- No insight

'Hold off' on immediate plans to return to work/school & "no driving"; re-Ax in one year

Patient 3

- 45 yr. old female healthcare worker
- Low speed collision w no LOC, no amnesia, no alteration of consciousness; no imaging findings;
- Gradual decline in functioning over 2 years post accident
- Appears similar to pts w profound sequelae of TBI

- NP = 'normal' with *no indication of feigning or malingering*, but;
- Longstanding history of physical & sexual abuse thought to precipitate a psychological response to minor trauma
- Dx of Functional Neurologic Disorder (Conversion)

Discontinue ABI rehab and focus on psych/SW

A frequent question from the patient's point of view?

"How do you know that these tests scores relate to how I am now versus how I might have been before I became: [injured, sick, suffered a lack of oxygen, etc.]?"

THE ANSWER?

Patient's test scores are related back to *comparison standards.*

1. Based on group scores & known general profiles of performance, and
2. Based on the patient's individual characteristics, combined with:
3. Clinical judgment/opinion

NP - Back in the day…

- NP used to 'localize' lesions and establish diagnosis
- Halstead-Reitan approach and the Impairment Index
- Advent of neuroimaging
- Purpose of NP changed from Dx to Ax

Modern practice

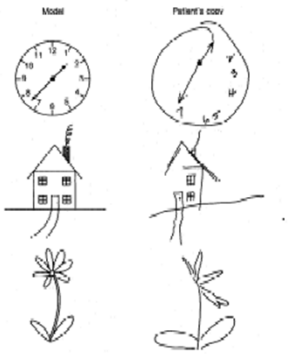
The 'Flexible' battery approach

1. Structured, extensive clinical interview(s).
2. Behavioural observations.
3. Administration of standardized, normed*, putative NP tests that infer either normal or abnormal brain function.
4. Integration of 1, 2 & 3 into a "makes-sense" opinion.

*most frequently

Non-normed tests

Copying:



Spontaneous drawing:

Neuropsychological Testing:

Aims to 'sample' the various domains of cognitive functioning in the patient along the *dimensions*, e.g.:

- Orientation and awareness, attention and concentration
- Intellectual capacity (Verbal and nonverbal/spatial)
- Memory (Verbal and nonverbal)
- Executive functioning, constructional ability

No ‘set’ process, but a good assessment should include measures of:

- Intellectual functioning
- Functional academic attainment
- Verbal/language functioning
- Learning
- Memory
- New problem solving
- Abstract reasoning
- Constructional ability
- Motor speed/coordination
- Mood/personality functioning

...and validity testing

Validity Testing

- Performance validity, or effort
- Symptom validity
  - Not mandated but essential because results of these measures frame the entire assessment
  - Stand alone (e.g., TOMM test)
  - Embedded

Validity Testing*

- In the 'old days', no validated way to determine whether the patient was feigning cognitive impairment or not giving a valid effort
- Several NP tests available for the past 20 years have been validated to determine cognitive feigning or poor effort on testing;
  - The NP assessment should employ one or more of these measures as a best practice
  - Assessing effort is the 'eye of the needle' which sets the tone of NP data quality

*'Failing' validity testing does not rule in or rule out TBI

The feeling when a patient 'passes' validity testing

Factors to be considered prior to the NP assessment

- Magnitude of injury and extent of the lesion (dose-response)
- Potential resilience of the individual (personality disposition)
- Premorbid cognitive and intellectual capacity
- Pre-existing psychosocial, psychiatric issues

Important!

- No magical properties in NP tests
- NP "tests" are surrogate measures of brain function/dysfunction; they do not confer a positive diagnosis; not like a blood test
- Many NP tests have high sensitivity and low specificity which can lead the clinician to draw false conclusions
- Must keep mind whether the whole clinical picture *makes sense.*

3. Interpreting NP Results

Skateboard TBI

- 19 yr. old male university student
- Strikes back of head on pavement
- Observations?
- Initial GCS?
- EMS GCS rating? ~12
- Gradual recovery to orientation
- CT/MR scans ++ for frontal contusions

Referred for NP at 5 months

Note: referrals < 3 months with moderate – severe TBI to be avoided (too much dynamic change happening)

Interview reveals…

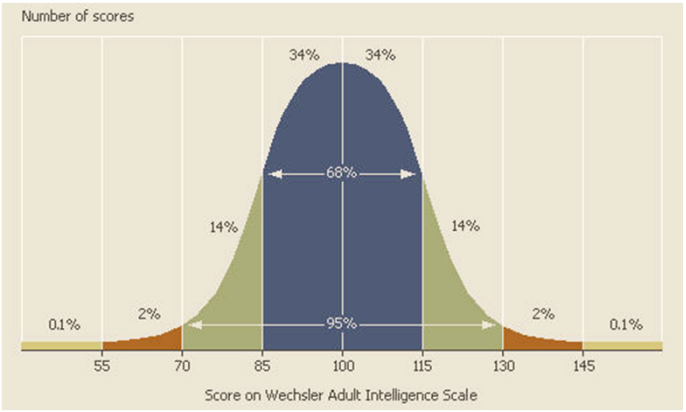
- "Average" student overall, weakness in math
- 2 prior concussions (also SB related) + new TBI
- Prior Hx of ADD, mild depression (both untreated); has academic accommodations in place already
- No other health, psychosocial issues
- Patient is symptomatic with headache, dizziness, cognitive "issues"
- Pleasant during appointment but parents note son is impulsive, angry, w labile mood
- Fatigue

NP Test protocol

(2 sessions b/c of fatigue)

- WAIS-IV, plus additional measures of processing speed
- Neuropsychological Assessment Battery (NAB)
- Trails A & B
- Wisconsin (128) card sort test
- Verbal Fluency, Naming, measures of core academic functioning
- SIMS, TOMM
- CVLT-II
- Rey figure drawing, recall
- Mood and personality inventories

The Normal Curve: IQ



Reporting Scores

Impaired	< 2 Percentile
Borderline	2nd to 9th
Low Average	10th to 25th Percentile
Average	26th to 75th Percentile
Above Average	76th to 91st Percentile
Superior	91st to 99th Percentile
Very Superior	> 99th Percentile

Results

- No indication of poor effort or feigning
- Above average IQ with statistically significant (lower) performance vs. verbal measures; high avg. verbal and borderline performance
- Impaired processing speed
- Impaired short/long term recall for unstructured verbal lists
- Impaired fine motor speed and coordination L hand

Summary

- Pt had moderate to severe TBI as documented by history and EMS notes, hospital records and corroborated by imaging data (and GoPro)
- At 5 months, there is indication on NP testing of relative *declines* & *impairments* compared to same age, education normative data, consistent with effects of moderate to severe TBI

Recommendations

- No return to studies at this point (January 2017)…plan for return in Sept 2017 w gradual resumption of studies (2 courses…3 courses) under guidance of OT or SLP pros
- Continued academic accommodations
- Continued therapies with OT, SLP, SW
- Good sleep hygiene
- Refrain from alcohol, other, less legal things
- NO SKATEBOARDING (ever again, ever)
- Repeat Ax in 12-16 months

The Report

- No rule of law that says psychology reports have to be 60 pages long (which may tell you more about the writer than the patient).
- Should contain the reason for referral
- Should contain a summary of the HPI along with background
- Summary of results and a test list
- Should provide a clear opinion and summary

4. Pros and Cons of NP

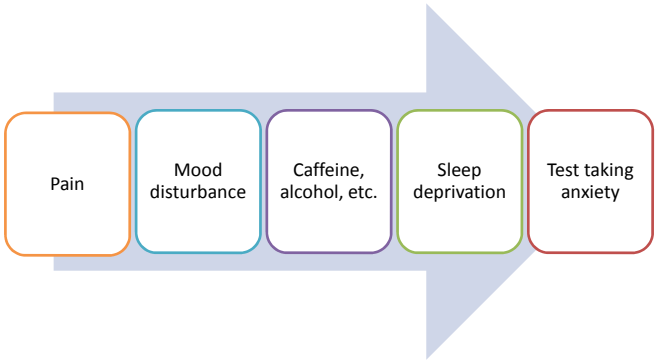
NP Helps *validate* or *challenge* the patient's perception of cognitive limitations:

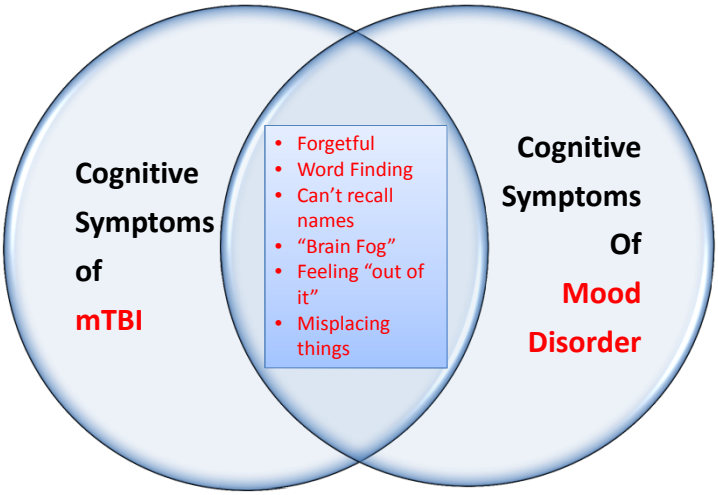
"I can't remember anything"

- Scored poorly on age-related peers on every, validated, standardized memory assessment test battery available (validation)
- Scored well above age-related peers on every, validated, standardized memory assessment test battery available (challenge)

NP Testing Weaknesses:

- NP tests are <u>not</u> tests of brain injury, so results cannot be interpreted out of context
- Especially in mild TBI, scores may not be sensitive enough to detect declines or impairments related to the person's complaints; OR
- There may be '<u>confirmatory bias</u>'
- There may be <u>practice effects (i.e., non-reliable test score changes</u>
- Factors other than TBI can influence NP scores
- Cognitive symptoms of mTBI may be non-specific


Pain
Mood disturbance
Caffeine, alcohol, etc.
Sleep deprivation
Test taking anxiety


Cognitive Symptoms of mTBI
Forgetful
Word Finding
Can't recall names
"Brain Fog"
Feeling "out of it"
Misplacing things
Cognitive Symptoms Of Mood Disorder

Important to remember

- TBI is an injury of individual differences, so each NP profile is unique to the person and the circumstances

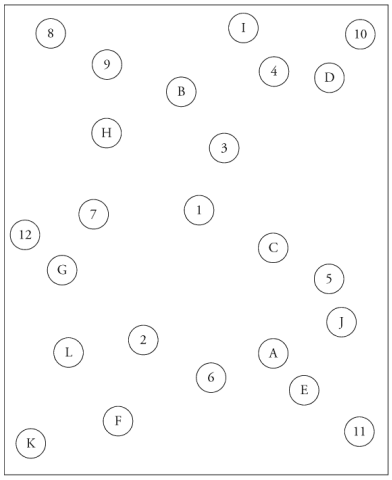
5. Red Flags in the NP Ax

- 'Failed' validity testing, including the '*wallet test*'
- Minor injury magnitude w across-the-board moderate to severe impairments
- Widely divergent medical reports
- Declining cognitive profile in the absence of other intervening neurologic factors
- No apparent functional impairment while describing numerous symptoms, e.g., *can't attend school, but able to play sports*.

5. Other issues/FAQ

Driving

How does this:



Predict this?

Screening Tools for Cognitive Function and Driving [Internet].

Smedslund G, Giske L, Fleitscher H, Brurberg KG.

Oslo, Norway: Knowledge Centre for the Health Services at The Norwegian Institute of Public Health (NIPH); 2015 Nov. Report from Norwegian Knowledge Centre for the Health Services (NOKC) No. 21-2015.
NIPH Systematic Reviews: Executive Summaries.

Excerpt

There are various reasons why persons holding a driver's license no longer retain the ability to drive a car. This might be ***e.g.*** stroke, traumatic brain damage, or early dementia. In order to assess the driving ability in persons with suspected cognitive impairment, there is a need for good tests that can categorize persons into three groups: (1) inability to drive a car, (2) sufficient ability to drive a car, (3) should be referred to a more comprehensive assessment of cognitive ability. In this report, we have provided an overview of existing cognitive screening tests for assessing functions of relevance for ability to drive a car, and how good the tests are for predicting who will pass an on-road driving test or who will experience a car accident during the first years after the screening test. Our key messages are:We have not found any cognitive screening tests that have good documentation of diagnostic test accuracy for predicting results on on-road driving tests. Tests that could detect at least 65 percent of dangerous drivers in all studies were the Montreal Cognitive Assessment (MoCa, detected 70-85%), the Clock Drawing Test (detected 65-71%) and the Trail-Making Test-B (detected 70-77%). We have in most cases little or very little confidence in the results. There was large variation in how good the tests were for predicting results on an on-road test. There is a need for standardization of the outcome measures and the test batteries in research about screening tests for driving ability. We can therefore not conclude about which tests are best for detecting persons with a reduced ability to drive among persons with a suspected cognitive impairment.

J Neurol. 2017 Aug;264(8):1678-1696. doi: 10.1007/s00415-017-8489-9. Epub 2017 Apr 19.

Driving with a neurodegenerative disorder: an overview of the current literature.

Jacobs M[1], Hart EP[2], Roos RAC[3].

Author information

Abstract

Driving is important for employment, social activities, and for the feeling of independence. The decision to cease driving affects the quality of life and has been associated with reduced mobility, social isolation, and sadness. Patients with neurodegenerative disorders can experience difficulties while driving due to their cognitive, motor, and behavioral impairments. The aim of this review is to summarize the available literature on changes in driving competence and behavior in patients with neurodegenerative disorders, with a particular focus on Huntington's (HD), Parkinson's (PD), and Alzheimer's disease (AD). A systematic literature search was conducted in the PubMed/Medline database. Studies using on-road or simulated driving assessments were examined in this review. In addition, studies investigating the association between cognitive functioning and driving were included. The review identified 70 studies. Only a few publications were available on HD (n = 7) compared to PD (n = 32) and AD (n = 31). This review revealed that driving is impaired in patients with neurodegenerative disorders on all levels of driving competence. The errors most commonly committed were on the tactical level including lane maintenance and lane changing. Deficits in executive functioning, attention, and visuospatial abilities can partially predict driving competence, and the performance on neuropsychological tests might be useful when discussing potential driving cessation. Currently, there is no gold standard to assess driving ability using clinical measures such as neuropsychological assessments, so more studies are necessary to detect valid screening tools and develop useful and reliable evidence-based guidelines.

J Am Geriatr Soc. 2016 Sep;64(9):1904-17. doi: 10.1111/jgs.14180. Epub 2016 Jun 2.

Cognitive Tests and Determining Fitness to Drive in Dementia: A Systematic Review.

Bennett JM[1], Chekaluk E[2], Batchelor J[2].

Author information

Abstract

Evidence has shown that although all individuals with dementia will eventually need to stop driving, most can continue to drive safely early in the disease. Fitness to drive needs to be monitored, and the use of cognitive testing to determine driver safety has been suggested. This review is the first to examine cognitive test results pertaining only to individuals with dementia. The aim was to examine the relationship between cognitive tests and driving to determine whether a cognitive assessment can be implemented as a tool to examine driver safety. A systematic review of 28 studies investigating the relationship between cognitive functioning and driving in individuals with dementia was conducted. The results of this review demonstrated a lack of consistency in the findings, with some studies showing a relationship between cognitive testing and driving performance for individuals with dementia, whereas others did not. Results relating to individual cognitive tests and measures confined to a single cognitive domain were variable and not consistently associated with driving performance. Studies consistently found that composite batteries predicted driving performance. The findings from this review support the use of composite batteries comprising multiple individual tests from different cognitive domains in predicting driving performance for individuals with dementia. Scores on individual tests or tests of a single cognitive domain did not predict driver safety. The composite batteries that researchers have examined are not clinically usable because they lack the ability to discriminate sufficiently between safe and unsafe drivers. Researchers need to develop a reliable, valid composite battery that can correctly determine driver safety in individuals with dementia.

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Repeated NP Testing

- Why do it?
- When to re-test?
- When enough is enough…
- Need to understand reliable change v. practice effects

Cultural Diversity

- Important to gauge language proficiency even if English is not language of origin
- Intellectual capacity can be assessed with tests where language is not involved
- Testing can be 'loaded' on performance based measures
- "Take the patient as they are" and do your best.

Thank you!

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The Hull-Ellis Concussion and Research Clinic

UHN Toronto Rehab Foundation

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