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Presentation of rehabilitation for a traumatic brain injury in clinical neuropsychology

1 Clinical psychology :

Clinical Neuropsychology is a specialty in professional psychology that applies principles of assessment and intervention based upon the scientific study of human behavior as it relates to normal and abnormal functioning of the central nervous system. Practice

Be careful not to be confused with cognitive neuropsychology.

2 Cognitive psychology

Cognitive neuropsychology is a branch of cognitive psychology that aims to understand how the structure and function of the brain relates to specific psychological processes. Theory

3 Cognitive rehabilitation

It is a set of procedures aimed at providing the patient with the behavioral repertoire necessary to solve problems or to perform tasks that appear difficult or impossible since the brain injury

4 History of cognitive rehabilitation

Walter Poppelreuther, was a German psychologist and neurologist, he worked with brain injuries of the First World War' soldiers. His psychometric tests are often used in visual neuropsychology, especially the Poppelreuter figure visual perceptual function test.[1]

Law : Poppelreuter's Law is a law of physiological training that states that when teaching a skill requiring both speed and accuracy, it is better in the early stages to limit speed and practice until a certain degree of accuracy has been attained, and then gradually increase the speed.[5]

Alexander Romanovich Luria (16 July 1902 – 14 August 1977) was a Soviet neuropsychologist and developmental psychologist. He was one of the founders of Cultural-Historical Psychology. Luria is widely known for two extraordinary psychological case studies: of a man with a highly advanced memory, published as "The Mind of a Mnemonist", and of a man with traumatic brain injury, published as "The Man with a Shattered World".

Test : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3399685/>

Methods :

One of the important diagnostic distinctions in cognitively impaired persons is between frontotemporal dementias (FTD) such as Pick disease and Alzheimer's disease (AD).

Unfortunately, the ordinary office-based psychiatrist's verbal mental status examination is often not sensitive to the executive function deficits associated with frontal lobe damage, and clinicians must rely primarily on history to make the diagnosis of FTD

In our clinic, the procedures of the three-step Luria test require that patients imitate three hand motions performed by the examiner. With fingers fully extended and the patient following, the examiner places his right hand with a cutting motion on his right knee or on a table, then in a fist with the knuckles down, and then palm down with fingers extended. Examiner and patient then repeat this three more times. The hand motions could be reinforced by counting from 1 to 3 along with each segment, or by saying "cut, fist, and slap." Patients are then asked to repeat the movements unguided by the examiner.

A score of 0 is recorded if the patient is unable to mimic the movement or complete three independent cycles. Luria's order of progression was fist, cut, and slap (Luria, 1970; 1980); others have used the sequence of slap, fist, and cut (Cummings and Mega, 2003). Performance on the Luria test was scored as normal or abnormal. The test was judged to be abnormal if the hand motions differed in type or sequence from that of the examiner. A common error was having the fingers flexed instead of extended for the first movement.

All subjects underwent standardized psychiatric, neurological and neuropsychological evaluation as described elsewhere (Weiner et al., 1991). Control subjects were individuals without subjective memory complaint (confirmed by an informant) whose neuropsychological testing was within normal limits for age and education. Clinical diagnoses were made by a clinical algorithm based on standard criteria for MCI that included amnesic, multiple domain, and single domain non-memory MCI (Petersen et al., 2001). For MCI, we required cognitive task performance > 1 SD below normative population. FTD was diagnosed using the criteria of Neary et al. (1998) and probable AD using the NINCDS/ADRDA criteria (McKhann et al., 1984).

Clinical staging of subjects at the time that the test was performed was based on the CDR, which rates global impairment as 0 = unimpaired, 0.5 = questionably impaired, 1 = mild dementia, 2 = moderate dementia and 3 = severe dementia. The diagnosis of "normal" required CDR = 0; for MCI, CDR = 0.5. A diagnosis of FTD required CDR \geq 0.5 and AD required CDR \geq 1.0.

Conclusion: The three-step Luria test distinguished NC and persons with MCI from FTD and AD, but did not distinguish FTD from AD subjects.

Kurt Goldstein : While working on brain-injured patients during World War I, neuropsychologist Kurt Goldstein observed that symptoms did not explain the disease, but were "a manifestation of the total organism" (Hall & Lindzey, 1959). In other words, the organism behaves as a whole, not as a collection of parts. Goldstein saw that the mind and body could not be separated, that they must be observed as part of a system; that which affects the mind affects the body and vice versa.

The laws governing the parts of the organism govern the whole organism, and

Understanding how the parts of the organism function requires discovering the laws governing the whole organism.

5 What's a traumatic brain injury

Traumatic brain injury occurs when an external mechanical force causes brain dysfunction. Traumatic brain injury usually results from a violent blow or jolt to the head or body. An object penetrating the skull, such as a bullet or shattered piece of skull, also can cause traumatic brain injury

6 What are the protections of the human brain ?

The skull is a bony structure that forms the head in most vertebrates. It supports the structures of the face and provides a protective cavity for the brain

The main functions of the meninges include:

Protecting the brain and spinal cord from mechanical injury

Providing blood supply to the skull and to the hemispheres

Providing a space for the flow of cerebrospinal fluid.

This layer of protective tissues is collectively named the "meninges" but is actually composed of 3 main layers: The Dura mater, the Arachnoid layer, and the Pia mater.

Cerebrospinal fluid (CSF) is a clear, colorless body fluid found in the brain and spinal cord. It is produced in the choroid plexuses of the ventricles of the brain. It acts as a cushion or buffer for the brain, providing basic mechanical and immunological protection to the brain inside the skull. The CSF also serves a vital function in cerebral autoregulation of cerebral blood flow.

So as you can see, there are several layers of protections. Even we have all that protection; we can still risk a brain injury. Why ?

Because, the evolution of our brain and his protections wasn't for cashing shots. Here I will show you some animals with the ability to cash shots.

These animals can withstand significant shocks to the head without being injured, because their brain has evolved to be able to resist this kind of blows.

7. The cognitive sequelae of cranial trauma

-Often the deficits can go unnoticed and we speak then of invisible handicap, as the anosognosia (a syndrome in which the patient isn't aware of his state).

With this syndrome is not like the patient doesn't want to acknowledge his problems, but for him, everything is okay.

-Apathy is a state of indifference, or the suppression of emotions such as concern, excitement, motivation, and/or passion. An apathetic individual has an absence of interest in or concern about emotional, social, spiritual, philosophical and/or physical life and the world. Sometimes apathy can be confused by depression, but there are not suicidal thoughts.

-Emotional lability: individual may change moods quickly and experience emotions in extreme forms. Sadness or anger, survivors of TBI are susceptible to frequent bouts of frustrations. Depression can also plague many TBI patients

-Attention/concentration impairment: reduces the ability to attend to an activity or information and leaves individuals susceptible to distraction by external or internal stimuli.

-Fatigue: This symptom typically improves spontaneously, but extremely slowly. Some TBI patients endure chronic fatigue which greatly hampers their activity level and employability.

-Judgement, problem solving, decision making and organization skill: Impairment in these areas leads to a great deal of difficulty, discontent and risk for the TBI patient.

-Executive functioning is the ability to formulate a goal, plan and carry out goal-directed behaviors effectively. Impairment in this functioning may lead the TBI patients to avoid decisions, make impulsive choices. They may be capable of performing a specific task but unable to structure themselves to do it.

Often it's mistaken by family members and professionals for laziness or lack of motivation.

-Memory problems are one of the most common complaints following even mild TBI. For instance, it can be useful to have the individual use a datebook.

- Personality disturbance and social isolation, Lezak (1987) indicates that personality and emotional disturbances may be more restricting than the cognitive or physical disabilities which follow traumatic brain injury. Using an adaptability inventory divided in 3 parts, she found that the areas having to do with social adjustment were the most impaired.

- masking, many TBI patients become expert at masking their deficits and presenting a public persona. Some family and friends seeing them ambulatory and without obvious physical impairment may treat them as fully recovered. Survivors of TBI are seen by a lot of medical, legal and insurance professionals. They lose considerable control over their own lives.

8) The cognitive approach

There are two different methods for the assessment with this approach. First one is the psychometric method, in a few words. Every patient are evaluated by the same battery, It is not necessary to have received specific training to be able to pass this type of test.

In all the test which can exist, two are the most common, the first one is the luri-nebraska test: a standardized test that identifies neuropsychological deficiencies by measuring functioning on fourteen scales. It evaluates learning, experience, and cognitive skills. This one is inspired by the previous work of Luria, it was invented by Charles Golden in 1981.

the second test is the Halstead –Reitan battery: is a fixed set of eight tests used to evaluate brain and nervous system functioning in individuals aged 15 years and older. There is a test for the children too. <http://www.minddisorders.com/Flu-Inv/Halstead-Reitan-Battery.html>.

The Halstead-Reitan is typically used to evaluate individuals with suspected brain damage. The battery also provides useful information regarding the cause of damage (for example, closed head injury, alcohol abuse, Alzheimer's disorder, stroke), which part of the brain was damaged, whether the damage occurred during childhood development, and whether the damage is getting worse, staying the same, or getting better. Information regarding the severity of impairment and areas of personal strengths can be used to develop plans for rehabilitation or care.

Read more: <http://www.minddisorders.com/Flu-Inv/Halstead-Reitan-Battery.html#ixzz4fkqmV6CB>

The second one is the adapted approach: Is more flexible and characterized by a more limited number of tests, For a better assessment guided by individual cognitive and neuroanatomical data. It Requires a thorough knowledge of the discipline and is characterized by an assessment adjusted to each patient.

This method combines the traditional classifications of neurological symptoms with the principles of cognitive psychology, The selection of tests is guided by general and individual factors. For the general factors, The choice of the tests is guided by the knowledge of the etiology of the lesion and the functional cerebral organization. It's useful in clinical to be guided first by the basic concepts, like Left hemisphere treats verbal material and right hemisphere, non-verbal material.

The results obtained from the various tests must be provided with qualitative and objective observations and a semi-structured interview. This interview realize for the behavior of the patient during the consultation and in his daily life.

9) Neurological examination (grassi test) test sur les couleurs !!!

The cognitive deficits of the patient can be identified only with a thorough and well-organized neuropsychological examination. The work of the neuropsychologist is to define what the altered capacities are, how they are, and the preserved capacities.

It is the cognitive, emotional and behavioral consequences of brain lesions that are examined by tests.

Tests :

The vast majority of tests used in neuropsychological clinics have been designed to measure a particular function and are standardized, It is easier to use them, the method of passing and rating, often being published with the results obtained in a reference group of healthy subjects.

The results of the patient are compared to the average of the subjects, of course with the same age, sex, origins... The standardized tests are the base of any assessment interview. In addition of the results, The report of the examination must also incorporate a short qualitative assessment.

Important information about the assessment, often the time is quite short.

The moment for the examination is important too, If the examination takes place after 1 month the accident or one year after, that implies totally different tests or goals.

10) Goals requirements of the neuropsychological evaluation

- The neuropsychological examination must make it possible to pronounce on the organic character of the behavioral alteration. Why? Sometimes patients, around 60, just complained about their memory. They worried to have Alzheimer or a sort of dementia. Even with the physical examination, we can't find the problem. So the neuropsychological examination is really important.

- The second objective is to determine the impact of the lesion on the patient's mood. The neuropsychologist will be able to come to more complete conclusions, considering of the results because the depressed mood may have a negative influence on several cognitive tests.

- The third objective is one of the specialties of clinical neuropsychology, appreciation of possible secondary effects of neurosurgery on cognitive abilities. The most common situation, when a person who suffer from epileptic crisis with no possible medication, ask for surgery because it's the only way to decrease the crisis. When the epileptogenic place is located in the medial temporal lobe, it's necessary to test the memory and language abilities after surgery

- The last goal is the cognitive evaluation which concern the rehabilitation of the patient. It is necessary to take stock of the general consequences of cognitive deficits, which necessitates clinical observation in various contexts of daily life.

The patient-neuropsychologist interaction should not recall a student-teacher interaction. The professional who's exercises neuropsychology has to be aware that he's interacting with a person who's suffering from one of the most stressful affections: Brain Injury. Certain attitudes of the neuropsychologist during evaluation such as distance or coldness may have a negative influence on the patient and his cognitive performance.

The three requisites which the neuropsychologist must verify their presence, during the initial interview, with the patient and a close relative. These three are very important, if one of them is missing, can failed the examination and the final result. First the patient must be able to maintain a sufficient level of attention to understand and follow the instructions as well as to carry out the tests. The duration of the sessions can be 5 to 10 minutes if the patient's really tired, and 3 hours for a complete evaluation. Each 30-45 minutes, it's necessary to have a break, and the duration for the breaks depends of the attention level of the patient.

The fatigue is also an important factor, because it's one of the reasons for a lack of concentration. Pain, especially Headache, anxiety or depressive mood and lack of sleep are the most frequently causes for a lack of concentration.

It's important to ensure that the patient understands the instructions and is physically able to perform the tests.

The third one is the motivation. A lack of motivation can be harder to be evaluated. Indeed, low performances can be attributed to the difficulty of the test. The experience shows that the global consideration of the cognitive profile collected in a demotivated patient presents contradictory results.

The depressed patient can't provide the needed effort to perform a cognitive task, especially if it asks an attentional effort. And in this case memory tests based on free recall are more sensitive to depressed mood than recognition memory tests.

There is a problem in some patients and often in the context of forensic experiments. This problem is a motivation for failure, for obtaining a secondary, usually economic, gain. In this case it is a patient simulator

Statistically, it is very rare to commit more than 50% errors and cannot exceed 60% for Verbal and non-verbal recognition memory tests. But why it's impossible? Because these tests require a forced choice response. If we notice this statistical break, this indicates that the patient is able to choose the error to degrade his performance.

11) The stages of neuropsychological evaluation

Before the examination, it is necessary to know the context of this examination. The request for examination shall be accompanied by a letter or a note from the doctor stating the purpose. If the neuropsychologist has not received such written or oral indications, he or she shall request them before the examination. He must then consult the medical file, the purpose is to inquire about the etiology of the lesion, suspected or verified. If the lesion was verified then, there is a file "brain imagery", certainly an MRI.

We can say we will have "read" a file if we are able to answer these 7 questions:

- 1) What's the etiology?
- Etiology refers to the factors or causes that are responsible for, or related to, the development of disorders. Mental and psychological disorders arise from internal factors, loss, pain, environmental factors, etc. and it is important to recognize these factors in their importance and balance.
- 2) The location of the lesion?
- 3) The time of the accident or the onset of symptoms?
- 4) There are cognitive deficits?
- 5) Which ones?
- 6) Since when?
- 7) Taking medications that may interfere with attention or mood?

The next step is the interview with the patient, and sometimes with relatives of the patient. The first contact involves establishing a good relationship and obtaining a series of additional information. The main goal is to have a good overview of the patient's cognitive difficulties, Get his own narrative of the impact of his problems have in his daily life. (10 minutes maximum).

During the interview 3 groups of questions are normally asked. And if the patient is no longer able to respond, they are then put to a close relative of the patient, but preferably after the interview and without the patient.

The first group of questions is factual questions, here some examples:

- Birth date
- Age
- Are you married?
- Up to what age did you study?
- Do you have children, Grandchildren?
- What is the level of your studies?
- Which hand do you use to write, Cut a sheet with scissors?
- Sometimes necessary to present Oldfield's scale of laterality from which these examples are drawn

The second set of questions is more elaborate, here again a few examples of questions:

- Can you explain to me your everyday difficulties
- And if for example the patient responds that he does not remember anymore or he put down his glasses
- The rest of the questions will be focused on this difficulty
- Otherwise we continue to ask the questions developed
- What is most problematic in everyday life, where, how and when
- Do you take some drugs?
- Do you have pain somewhere?

The last set of questions:

- What are your daily activities
- Do you have a job?
- What are your hobbies?
- Do you see your close relatives, friends, and neighbors?
- What events of the current world can you comment to me
- What's going on in a special country?

The answers to the questions during this interview will affect the continuation of the review. Some things may prevent interview from happening. Like drugs or alcohol, enough to mistake the results, the patient need more a psychiatric than a neuropsychologist, or he can't speak the language.

12) General Neuropsychological Assessment

Every neuropsychological assessment should be able to provide a relatively general picture using tests that measure the following cognitive functions:

- Ability to reason
- Memory
- Language
- Calculation
- Visuo-perceptive capacity
- Executive functions

To evaluate each of these functions, the neuropsychologist selects the type of test that is appropriate for the patient, knowing that there are a variety of tasks for different levels of examination for a specific function.

Evaluation of current cognitive efficiency and its pre-morbid estimate

In neuropsychology, Intellectual deterioration refers to a level of loss of cognitive ability greater than the normal loss due to age. To identify possible deterioration, current cognitive efficiency should be compared to pre-disease efficiency.

The WAIS scale is the most widely used efficiency battery and one of the most standardized intellectual assessment instruments in psychology

The WAIS scale is the most widely used efficiency battery and one of the most standardized intellectual assessment instruments in psychology. Composed by 4 sub-tests of the verbal scale:

- Vocabulary
- Memory of numbers
- Arithmetic
- Similarities

And three sub-tests of the performance scale:

- Pictures completely
- Images settings
- Brick settings

This battery was not designed for neurological patients and has no critical values for diagnosis. The difference between the two scales guides the continuation of the examination, but does not allow us to conclude solely on this basis, to a dysfunction of either hemisphere. An example: The scale of performance, whose scores at all subtests depend on the time of realization, It should not be forgotten that neurological patients often have a mental slowdown. It would not be correct to conclude that a patient has a deficient IQ because he is unable to complete the performance subtests in time. If we observe a mental slowdown, it's more informative to test the un-verbal reasoning with untimed tests like Raven scales.

!! It is necessary to considering his previous intellectual level.

To estimate the premorbid intellectual efficiency, the most common way is to assume a certain correspondence between the intellectual level and the number of years of schooling.

The Bac level => IQ=100

A level Bac+4/5 =>IQ= 115/120

If the patient has learned a second language as an adult we estimate his pre-morbid Qi to 100, If he became polyglot in adulthood we estimate his IQ at the higher interval.

Another way to estimate his intellectual level before the lesion is to take the best score on one of the sub-tests of the WAIS scale, or score on a reading test of irregular words (NART scale) or a score to a vocabulary test.

This choice is based on observations that indicate that verbal skills are less sensitive to the effects of brain damage than memory or problem solving unless the patient has speech impairments

Attention

Two dimensions of attention determine the quality of information processing, selectivity and intensity. The perception, processing and storage of information require attention to be directed to the task and the level of intensity adapted to the task too.

An important point for neuropsychological evaluation is that the selectivity and the attentional intensity of the patient depend on the proposed task.

The choice of tests measuring different aspects of attention depends on the neurological condition of the patient and the demand for examination.

In clinical practice, careful observation of the patient is the most effective and widespread tool in the assessment of attention, and this observation is also important in a test situation.

The realization time is not limited in advance but it is strictly timed. There is a standardized scale of attentional observation (Ponsford Kinsella 1991).

Designed for patients with head trauma, it contains 14 questions and 5 frequency levels for each item.

Two attentional processes interact during tasks, the speed that reflects the processing capacity, and the control or working memory. The speed and the attentional control vary from one task to another depending on the degree of structuring of the task and the pressure imposed by the limited time. These characteristics are accompanied by a level of difficulty of response coherent with its factors.

If we want to evaluate the speed, the task must be well structured, the answer very simple and the control component almost absent. If we want to test the control, the task must be opened, no control instructions are given explicitly, there is no time limited.

The evaluation of clinical attention is more frequently carried out by testing the contribution of the two processes, which implies that success in a given task depends on speed but also on some control of information.

For an example Stroop test.

13) Others approaches

Functional approach:

To develop autonomy in the daily life of the patient by
- training his behaviors that are useful for everyday life.

- Bathroom, clothes, food
- Traveling, orientation/landmarks
- Car ride between home and work, shopping center, ...

-Communications and relations

Then you have to develop self-reliance with meals, shopping, washing, cleaning the house, taking

care of the children. Afterwards, social autonomy has to be developed, Administrative paper, budget, community life, decision making and coping with novelty

Global approach, centered on the person, his psychological evolution and the restrictions that he undergoes.

Holistic approach (Ben Yishay, Prigatano):

- Cognitive rehabilitation, psychotherapy et social integration
- Integration in a group of patients with the same cognitive deficits, self-awareness, self-confidence, self-esteem
- Therapeutic alliance

Neuro-systemic approach (Mazaux, Destailats, Belio 2011):

- according cognitive impairment
- interested in The relational triangulation between the injured, his family and the institution
- Which can generate misunderstandings, or even reciprocal disqualification processes
- Which are expressed by behavioral disorders

Application principles

- Always integrated into an overall therapeutic project
- Inseparable from psychological evolution

14) Conclusion

The benefit of appropriate assessment is the ability to choose the tests according to the etiology and condition of the patient. The success of this type of examination depends on our neuropsychological knowledge, particularly on cerebral organization of functions and on cognitive models. The evaluation should respond primarily but not only to cognitive questions, behavior and observations on the emotional repercussions of the lesion are all questions to which the neuropsychologist must answer.

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