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Luria's Syndrome for Neuropsychological Rehabilitation of Adolescents

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Abstract

Neuropsychology, as a science, studies possible relations between psychological processes and brain in cases of normality and diverse pathologies. Such kind of relations might be established and understood by different manners. A.R. Luria proposed unique and particular way of approach by brain units. Such conception is not completely understood and even less used in practice of diagnosis and rehabilitation today. Neuropsychologists provide assessments of isolated functions by help of psychometric procedures. The judgment of diagnosis refers to such terms as "attention or memory disorders", dyslexia and so on. All these terms are really far away from the conception of systemic and dynamic representation of human actions in functional brain systems. Same or worse is the situation with rehabilitation directed to isolated operations as conductive exercises for isolated functions. The objective of our report is to share opinion of application of Luria's methodology of syndrome analysis. Procedures of systemic functional diagnosis must conduct to systemic procedures in rehabilitation. An example of qualitative assessment of adolescent patient with brain injury is presented. Goals, stages and examples of formation of actions in rehabilitation with results are provided. Psychological conceptions of stage by stage formation and orientation base of action and its usage for rehabilitation is taken into account. We conclude that systemic and dynamic approach in neuropsychology might be conducted in reality of assessment and rehabilitation. We discuss the necessity of establishment of bridges between psychological theory of actions instead of functions and systemic representation of actions by functional brain systems.

Keywords: neuropsychological rehabilitation, concepts of neuropsychology, functional diagnosis, qualitative neuropsychology, brain injury rehabilitation.

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1. Introduction

One of important objectives of neuropsychological assessment in cases of brain injury is determination of specific neuropsychological syndromes. Luria has described classification of types of aphasia in adult patients with acquired brain injury [1–4]. Yet, it is

necessary to recognize that cases of acquired brain damage in adults don't represent totality of variety of possibilities of the usage of syndrome analysis in cases of brain damages or developmental disabilities and dysfunctions. The goal of this article is to show how methodology of Luria's syndrome analysis might be applied for assessment and rehabilitation of adolescent patient with brain lesion. This case is interesting because it shows new methodological possibility of syndrome analysis for assessment and rehabilitation according to specific psychological age of the patient.

According to our opinion, the topic of psychological age, proposed by Vigotsky [5], developed by Leontiev [6] and Elkonin [7] should be taken into account during the process of psychological and neuropsychological assessment and rehabilitation. Consideration of rector activity of the age might be used as the basis for creation of the program for rehabilitation and development of the patient. The objective of our report is to share opinion of application of Luria's methodology of syndrome analysis and to show how the procedures of systemic functional diagnosis must conduct to systemic procedures in rehabilitation.

It is important to stress that the determination of weak factor is not enough for determination of the whole syndrome and different level of analysis are necessary. Referring to Luria's proposal for classification of aphasia, different levels for analysis of neuropsychological syndrome were established [1, 8, 9]. These levels are: level of the central nervous system; level of neuropsychological factor or mechanism; 3) level of intellectual activity of the patient; 4) level of verbal activity.

The levels of analysis, within the system of neuropsychological syndrome are:

1. Involved neuroanatomical structure of central nervous system.
2. Weak neuropsychological factor/ factors.
3. Practical and intellectual actions correspondent to of psychological age and personality of the patient.
4. Verbal oral and written comprehension and production, suffered as the consequence of the weak neuropsychological factor.

In this article, we express that the goal of functional neuropsychological assessment is directed to establishment of weak and strong brain mechanisms [10] as the factor or reason of the patient's difficulties [11–13]. The same mechanism usually belongs to different functional systems. For instance, the mechanisms of programming and control take part in solution of mathematical problems and in writing process. Same situation occurs with the mechanism of spatial integration.

It is obvious that our approach for syndrome analyses requires the usage of specific instruments for assessment. Traditional and psychometrical methods are helpless for the goal of achievement of syndrome analysis. All protocols and instruments for qualitative analysis should be specifically created according to each language [14] and each psychological age [15, 16].

2. Clinical Case

The study was accomplished with a case of adolescent patient with traumatic brain injury. The participant was 12 years old at the moment of the accident. He was admitted at the hospital presenting loss of consciousness, Glasgow 7, multiple bone fractures and optic nerve detachment. This situation led to vision loss of the left eye.

One year after traumatic brain injury, the patient attended the Neuropsychological Service at the University Hospital provided by the Master Program in Neuropsychological Diagnosis and Rehabilitation of the Faculty of Psychology of Puebla Autonomous University. The reason were severe difficulties with the process of school learning emerged after the accident. The learning was hardly possible and personal problems with communication with family and friends persisted. The patient showed symptoms of difficulties with concentration of attention, self-regulation, planning, mental flexibility, abstraction, visual-spatial ability and language production and comprehension.

Neuropsychological assessment was provided in 4 individual sessions. After assessment, the program for neuropsychological rehabilitation was designed and applied in 70 individual sessions in two period of 4 months with 6 month interval in between. Later on, final neuropsychological assessment was provided. Qualitative analyses of mistakes and achievements according to the findings of syndrome analysis was carried out.

The following instruments and protocols for qualitative assessment were used during assessment:

1. Brief neuropsychological assessment for adults para adults [17].
2. Assessment of school success [18].
3. Neuropsychological assessment of spatial integration [18].
4. Neuropsychological assessment of voluntary activity [19].
5. Neuropsychological assessment of verbal activity [19].
6. Clinical assessment of Aphasia Puebla-Sevilla. [17].

7. Assessment of intellectual activity [20].

Qualitative procedure of the data of assessment allowed to establish severe difficulties with two functional brain mechanisms: programming and control and spatial integration. Specific and typical mistakes were detected in all tasks and interaction during assessment were the following: verbal and mental perseverations, inversions, misunderstanding of complex grammar structures, impossibility for organization of written sentences and texts, impossibility of understanding of texts, impossibility of following of rules and order in all kind of complex intellectual tasks.

Neuropsychological syndrome identified in our study, according to established levels of analyses was as follows:

1. Involved neuroanatomical structure of central nervous system: adolescent with brain lesion in both left anterior and posterior cortical regions.
2. Weak neuropsychological factor/ factors: problems with regulation and control and spatial integration.
3. Practical and intellectual actions correspondent to of psychological age and personality of the patient: all types of secondary school intellectual actions, which include active self-regulation and spatial integration (specifically, difficulties with written production and problem solution).
4. Verbal oral and written comprehension and production, suffered as the consequence of the weak neuropsychological factor: difficulties of understanding and production of oral and written sentences and texts with complex grammar and syntactic structure.

It is possible to notice, that the same neuropsychological factors take part in a variety of difficulties presented by our patient. There is no need to assess separately language, memory, attention, reading, writing or executive functions in our patient. We believe that neuropsychological factors of regulation and control and spatial integration, applied to psychological age of adolescent are quite enough to understand neuropsychological syndrome of our patient and to provide useful program for rehabilitation. We insist that such an approach is close to one expressed in all known publications of Luria and in his famous short novels dedicated to the history of only one patient (Luria, 1987). The absence of such approach based of Luria's syndrome could conduct to traditional diagnosis of poor executive functions. Such conclusion wouldn't take into account severe difficulties with spatial integration, added to difficulties in regulation and control.

The study of EEG was also applied with posterior qualitative analysis of the data [21, 22]. The results of analysis of EEG allowed to concluded to establish local pathological patterns in both anterior frontal and posterior (temporal, parietal and oocipital) zones of complex information integration.

The program for neuropsychological rehabilitation was created and applied in two periods during one year with six months in between.

2.1. Program of rehabilitation

The Program for neuropsychological rehabilitation was divided into two periods of 4 months of treatment per each. Both periods of rehabilitation consisted of 35 individual sessions carried out 2 times per week, wwith the total of 70 sessions. Each session had duration between 60 and 90 minutes, according to conditions of the patient and other external conditions.

The program was designed according to theoretical principles of activity theory [23–26] and psychological concept of orientation [27, 28]. Self-regulation, self-verification and self-emotional critics were the criterion of the progress of the patient according to our program. The program was flexible and considered the patients' personality and personal interests.

The main goal of the program was to reestablish two involved brain mechanisms: self- control and regulation of the voluntary action during complex intellectual activity and integration of spatial information at different levels (materialized, perceptive and verbal).

Period 1

The first period of rehabilitation was dedicated to introduction of the strategies for regulation and control in practical day-to-day tasks and intellectual actions. External control provided by psychologist during joint actions directed to concrete interesting goals was guaranteed. Spatial integration was also included as the component of the tasks used during rehabilitation. The stages during the first stage of neuropsychological rehabilitation were: materialized actions, perceptive actions and verbal actions.

As an example of the tasks used on materialized, perceptive and verbal level, the work with geographic maps might be mentioned. During this task the patient was asked to locate continents, countries, oceans and cities on geographic maps. At materialized stage, the patient had to show the direction and location of geographic object

(a city or a country and so on) with the help of external plastic arrow or compass. The patient had to say orally if the city was above, below, to the left or to the right in relation to another geographic object. At perceptive stage, the patient had to paint with chosen color the direction from one geographic point to another. Specific "orientation card" was used to facilitate connection between vernal expressions of "left – occident"; "right – oriental"; "below – south"; "above – north".

At the level of verbal actions, the patient had to identify the relation of one geographic point to another one using both kinds of verbal expressions: spatial prepositions with geographic terms. The patient was asked to write down these expressions as sentences describing geographic relations. Different kinds of maps of cities, countries, continents and world were used during the sessions. Different roots for directions were used to reach a point on the map. Localization of the geographic objects in a coordinate system was introduced and used.

The Figure 1 shows an example of a pattern used during rehabilitation. In this task, the patient had to identify the order of the colors and to reproduce them in an empty circle. Firstly, simple models were used, and more colors and more complex shapes were used later on.

Figure 1: The model of the circle for training of rotation.

Period 2

The second period of rehabilitation was dedicated to re-establishment of self-regulation and control of the patient in complex intellectual tasks. Spatial integration was worked within verbal actions of production of sentences and texts with development of plan ach text.

Each activity was guided by psychologist providing external "orientation cards" to enhance self-organization, planning and structure [29]. Each card contained the steps needed to follow the order for solution of each task. At first, cards included detailed steps and then became more general, only pointing the key steps. After some sessions, when the patient could remember the card, he was asked to perform the task without it, only naming the steps out loud. Similar groups of tasks with different variants of the content were used in order to guarantee best level of generalization [30, 31].

The following steps for the procedure of solution of the problems were offered to the patient:

1. Analyze the problem identifying important data with different colors, according to your choice.
2. Find the final question and missing information.
3. Establish significant relations between the elements of the problem.
4. Explain your own words the content of the problem.
5. Write down the steps of the problem with symbols or with a diagram.
6. Solve the problem by steps according to the diagram.
7. Write down result.
8. Compare the result to the question of the problem.

3. Results

Neuropsychological assessment was carried out after the first and the second periods of rehabilitation. Important positive changes were observed at the end of each period of rehabilitation.

The Figure 2 shows examples of fulfilment of the task of copy of the house during initial assessment and after the first period of rehabilitation. The Figure 3 presents the

same task, while the Figure 5 shows positive changes in the patient's copying after the second period of rehabilitation.

Figure 2: The copy of the house during initial assessment.

Figure 3: The copy of the house after first period of rehabilitation. (After first period)

As the results of the second period of rehabilitation, the possibility for complex verbal written expression was achieved. The process of rehabilitation allowed the patient to achieve positive reintegration of the school activities and communication with the family and friends. The patient became able to complete individually home tasks, he became more responsible and motivated for all kinds of practical and intellectual activities in his life. Negative emotions disappeared. The patient became reflexive, critical and involved in his own achievements and difficulties. Impulsive behavior disappeared. The parents have expressed positive changes in day-to-day communication.

Figure 4: The copy of the house after the second period of rehabilitation. (After second period)

4. Discussion

The results of our study permit to confirm the usefulness of Luria's proposal of the concept and method of neuropsychological syndrome. Neuropsychological syndrome is useful both for assessment in cases of acquired brain injury and for creation and implementation of program for rehabilitation. Implementation of this methodology was possible and useful for the patient of psychological age of adolescence. Particular interesting feature of presented syndrome is the presence of two central neuropsychological factors: difficulties with regulation of control and with space integration. The first difficulty is the consequence of brain lesion in anterior brain region, while the second of the lesion in posterior brain region. Both lesions are in cortical areas of left hemisphere. Our study presents the case of combined neuropsychological factor in adolescent patient with acquired brain damage.

It is necessary to remember that Luria's theory has never appeared on an empty empty space. His theory is logical continuation of Vigotsky's conception of cultural development within divided actions between adult and child. In our case, the development was provided by an adult in goal directed tasks at different levels of actions. All action were significant and motivated actions for adolescence age. We want to stress here, that creation of such tasks would be impossible without continuation of great ideas of Vigotsky in the works of representatives of activity theory The central concepts of these theory, such as rector activity of each psychological age, the role of activity of verbal and non- verbal communication, formation of intellectual actions

by steps and external – internal orientation was created during same historical period as the main concepts of Luria's neuropsychological theory. We believe that modern conceptualization of this facts should be one of important tasks of neuropsychologists and psychologists.

5. Conclusions

1. Luria's syndrome analysis is a qualitative neuropsychological method and should be understood as the basis for assessment and rehabilitation.
2. Syndrome analysis is useful for the work with adolescent patients with acquired brain injury.
3. Formation of joint cultural activity as the origin of psychological development and also of neuropsychological rehabilitation in cases of brain injury. Specific stages and goals should be considered for elaboration of concrete programs.
4. Subject – object (subject) participation in motivated activity according to psychological age should be taken into account while working with adolescents with brain injury.

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