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NEURO PSYCHOLOGICAL BEHAVIOUR OF HEMISPATIAL NEGLECT: A SYSTEMATIC ANATOMIZATION ON ITS PARADIGM AND REHABILITATION APPROACH

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Abstract:

This article summarize about common neuropsychological brain disorder i.e., Hemispatial Neglect. Spatial neglect is a lateralized disorder of space related to behaviour of patients which is characterized by the failure to explore the side Neglect is associated with unilateral brain damage occur due to stroke and many other neurodegenerative disorders like neoplasia, trauma, cardiac infarction, etc. Many patients with neglect following stroke improve within a few weeks, but some continue to have persistent neglect that are likely to require rehabilitation input. It deals with the symptoms of typical patients and types of neglect observed in patients. The article discusses about the different types of test to assess the disease severity, the treatment methods and rehabilitation approach. The article also gives an idea about general strategies to improve the neglect symptoms in patients.

Key words: *Hemi spatial neglect, Contralesional Limb, Gross Distortions, Somatoparaphrenia, Prism Adaptation, Limb Actvation Treatment.*

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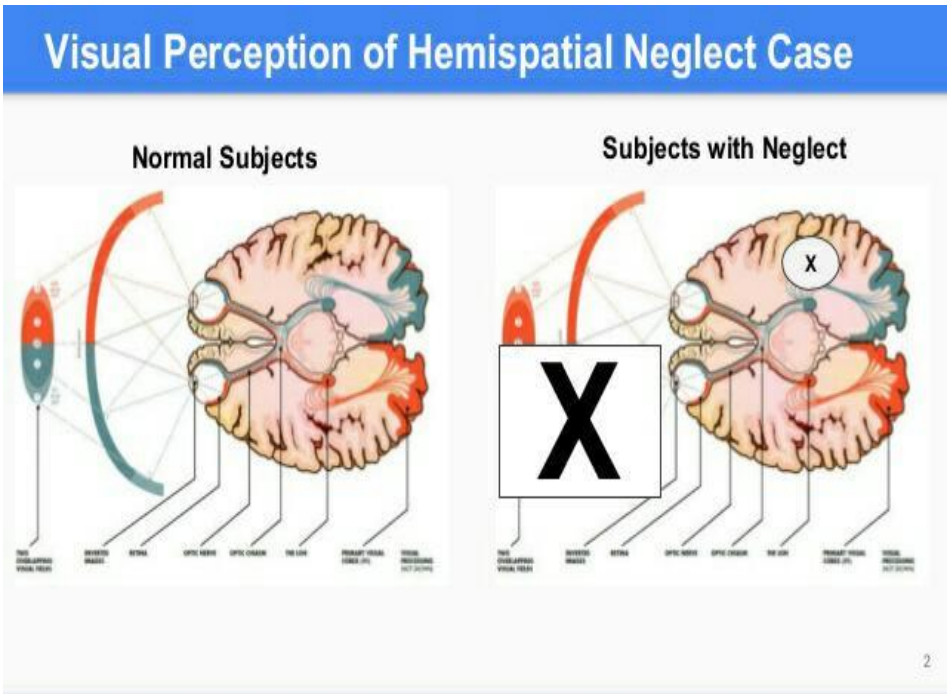
INTRODUCTION:

The Human Brain is a thinking tank has which is an object of interest that controls the body activities like processing, integrating and coordinating the information received and responds to it. The research on Brain has been carried out from a long time to know the purpose of dreaming, it functioning at a normal time and in diseased conditions. One of the major risks involving disease is ***Hemispatial Neglect***. It is a common neuropsychological Brain disorder following unilateral brain damage, particularly of the right hemisphere. Although it can be caused by various different pathological conditions including neurodegenerative diseases like neoplasia and trauma, it is most common in the context of hemispheric stroke and brain injury to the right cerebral hemisphere, with rates in the critical stage of up to 80% causing visual neglect of the left-hand side of space. Neglect is often produced by

Typical patients

People with moderate to severe neglect show a number of behaviors that are often clearly visible to relatives as well as clinical staff. The most severely affected patients direct their gaze towards the side of the lesion and should not get fixed on the person related to speaking. In addition, they may eat food only from one side of their plate, or pay less attention to one side when grooming, such that they shave, or apply make up to, only one side of their face Neglect may also be very apparent to therapists during rehabilitation. For instance, a wheel chair user may repeatedly bump into walls and objects on the neglected side, or may omit words when reading text on the one side of the page, or misread one side of individual words. Some patients do not use their contralesional limb even when there is no weakness or sensory loss, this is termed as motor neglect [2].

massive strokes in the middle cerebral artery region and is variegated, so that many of patients do not exhibit all of the syndrome's traits. Right-sided spatial neglect is rare because there is redundant processing of the right space by both the left and right cerebral hemispheres, whereas in most left-dominant brains the left space is only processed by the right cerebral hemisphere.[1] The terms unilateral neglect, hemi neglect and spatial neglect are used interchangeably. They are generally defined as an inability to perceive, report and orient to sensory events towards one side of space, contralateral to the side of the lesion, with or without a primary sensory deficit. Most patients with neglect for easy identify is not necessary. Moreover, it is important to measure the severity of neglect is increasing. Many patients with neglect following stroke improve within a few weeks, but some continue to have persistent neglect that are likely to require rehabilitation input.



Distinct forms of unilateral neglect

There are two main classification systems for unilateral neglect. Unilateral neglect is described in terms of the modality in which the behavior is elicited. Sensory, motor and representational occurs by the distribution of abnormal behavior with respect to personal and spatial.

Sensory neglect:

Sensory neglect is defined as unaware of the side of the body or the space opposite of brain lesions. It includes ignoring the contralesional sights, sounds and tactile stimuli. They typically behave as if half of their world not exist, so that in daily life they may only eat from one side of their plate, shave or makeup only half side of their face, draw or describe only the right side of the remembered image or place.[3]. Sensory neglect is also referred to as "inattention", "input neglect", "attentional neglect" and "perceptual neglect"

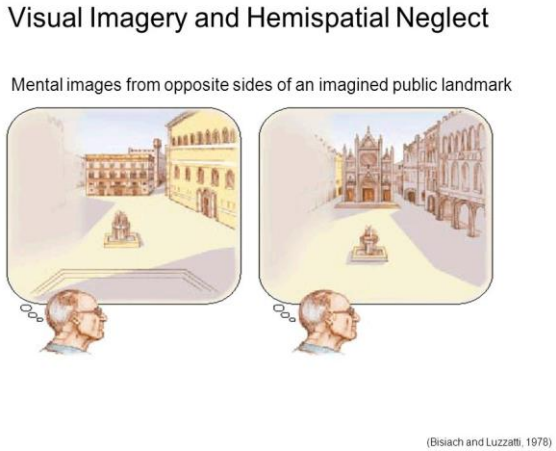
Motor neglect:

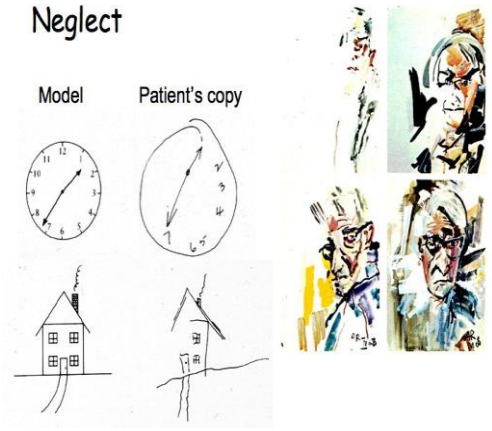
Motor neglect is defined as the failure to generate the response to a stimulus even though the person is aware of the stimulus. The patient with motor neglect does not use the contralesional limb despite the neuromuscular ability to do so. It occurs in the absence of paralysis, pyramidal syndrome, extrapyramidal symptoms and primary sensory deficit.

The symptoms of motor neglect are diverse: poor use of the affected limb, difficulty in bimanual activities such as opening a bottle, spontaneous gestures get reduced while speaking and lack of swing of the arm while walking. Motor neglect is also referred as "intentional neglect" and "output neglect" [4].

Representational neglect:

It is a condition in which a person ignores contralesional half of the internally generated image. Internally generated images are mental representations or visualizations of a tasks, action or environment. Representational neglect is also referred to as "imagery neglect.





Personal neglect:
Personal neglect is also referred to hemiasomatognosia, asomatognosia or unilateral asomatognosia. It is a condition in which a person neglects the contralesional side of the body. Examples of personal neglect are: failure to dress half side of the body or combing only half side of the body [5].

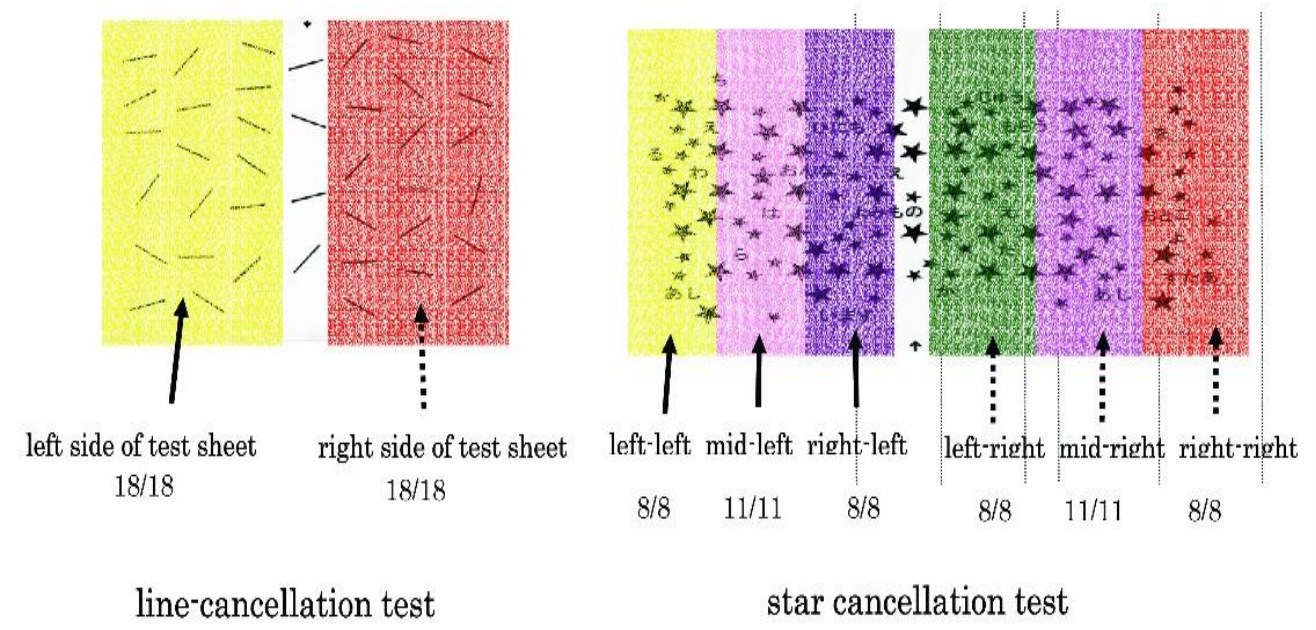
Spatial neglect:
Spatial neglect is a lateralized disorder of space related to behavior of patients which is characterized by the failure to explore the side contralesional to the lesion and to react or respond to the stimuli or the subjects located on this side [6]. Spatial neglect may be either peri personal or extra personal neglect. In spatial neglect a person is unable to attend to either the space within the reaching distance i.e. peri personal or to the space beyond the reaching distance i.e. extra personal.

ASSESSING THE SEVERITY:

Several simple screening tests have been developed for the assessment of neglect. One of the most useful types of test for neglect is the cancellation task. There are several different versions available. The patients are required to find and cancel [mark with a pen] target items distributed on an A4 sized sheet of paper placed in front of them. Some cancellation tasks have only target items. ***For example:*** Albert's task or line cancellation from Behavioral Inattention Test [BIT] battery, but most of them have targets embedded within an array of many different types of distractor items. ***For example:*** Bells test, Star cancellation from the BIT and the Mesulam shape cancellation test.

Line bisection and cancellation test

Line bisection test require people to estimate and indicate the midpoint of a horizontal line presented on a piece of paper placed in front of them. This test is measured by the deviation of the bisection from the true center of the line. A deviation towards the side of the brain lesion is usually regarded as being indicative of neglect. Cancellation test require the person to search for and cross out target symbols presented on a page. Patient with neglect fail to cancel stimuli on the side of the page opposite the brain lesion.



NOTE: LINE BISECTION AND CANCELLATION TEST CANNOT BE USED TO DIFFERENTIATE BETWEEN SENSORY NEGLECT AND MOTOR NEGLECT BECAUSE THEY REQUIRE BOTH VISUAL SEARCH AND MANUAL EXPLORATION.

Copying and drawing test

Copying simple figures and free drawing are used to detect neglect in patients following stroke. The figures typically used for copying include flowers, star, cubes and geometric shapes. Incomplete drawing or copying with omissions or gross distortions on the contralesional side is considered indicative.

Two drawbacks with this test include Subjectivity in the interpretation of the results and Insensitivity for identifying patients with unilateral neglect, not all patients with disorder perform abnormally on this type.

Many right hemisphere patients with left neglect cancel items of the right side of cancellation tasks, omitting targets to the left. Another simple pen and paper task that has been extensively used is line bisection. A long horizontal line marked on an A4 sheet of paper is placed in front of the patient and is asked to mark the apparent midpoint of the line. Many right hemisphere patients with left neglect, particularly those with posterior lesions, tend to mark the apparent middle of the line correctly to the right of the true midline.

Occurrence of neglect:

Neglect follows right cerebral hemisphere damage as a consequence of middle cerebral artery territory stroke. Although the syndrome is traditionally associated with parietal lesions, most middle cerebral artery strokes affect several regions and many patients show varying combinations of parietal, temporal and frontal damage. In addition, neglect follow subcortical stroke, cortical damage, subcortical ischemic lesions in the territory of the middle cerebral artery involving the right basal ganglia or thalamus that reflect diaschisis or hypoperfusion in overlying parietal and frontal regions which are demonstrated by both SPECT and magnetic resonance perfusion. It deals with the symptoms of typical patients and types of neglect observed in patients.

Varieties of neglect:

Neglect is a heterogeneous disorder that manifests radically differently in different patients. No single mechanism account for these different manifestations. A vast array of impaired mechanisms is found. These mechanisms alone would not cause neglect. The complexity of attention alone just one of several mechanisms that may interact has generated multiple competing hypothetical explanations of neglect. It is not surprising to assign particular presentations of neglect to specific neuroanatomical loci. Despite such limitations we may loosely describe unilateral neglect with four overlapping variables: Type, Range and orientation.

Types of spatial neglect:

These are broadly divided into disorders of input and disorders of output. The neglect of input, or "inattention," includes ignoring contralesional sights, sounds, smells, or tactile stimuli. Surprisingly, this inattention can even apply to imagined stimuli and is termed as "representational neglect," patients may ignore the left side of memories, dreams and hallucinations. Output neglect includes motor and pre-motor deficits. A patient with motor neglect does not use a contralesional limb despite of having normal neuromuscular ability. The patient with pre-motor neglect or directional hypokinesia, can move unaffected limbs in ipsilateral space but have difficulty in directing them into contralesional space. Thus a patient with pre-motor neglect may struggle to grasp an object on the left side even after using the unaffected right arm.

Ranges of spatial neglect:

Hemi spatial neglect can have a wide range in terms of objects that the patient neglects. The first range of neglect, commonly referred to as "egocentric" neglect, is found in patients who neglect their own body or personal space. These patients tend to neglect the opposite side of their lesion, based on the midline of the body, head or retina. ***For example***: In a gap detection test, subjects with egocentric hemi spatial neglect on the right side often make errors on the far right side of the page, as they neglect the space in their right visual field. The next range of neglect is "allocentric" neglect, where individuals neglect either their peri-personal or extra personal space. Peri-personal space refers to the space within the patient's normal reach, whereas extra personal space refers to the objects/environment beyond the body's current contact. Patients with allocentric neglect tend to neglect the contralesional side of individual items.

For example: In the same gap detection test, subjects with allocentric hemi spatial neglect on the right side will make errors on all areas of the page, specifically neglecting the right side of each individual item. This differentiation is significant because the majority of assessment measures test for neglect within the reaching, peri-personal and range. But a patient who passes a standard paper-and-pencil test of neglect ignores a left arm or does not notice distant objects on the left side of the room. In certain cases of somatoparaphrenia, which is caused by personal neglect, patients deny ownership of contralesional limbs.

Orientation of spatial neglect:

Depending on the orientation, the neglect has two types: The patient neglect objects to the left of their own midline [egocentric neglect] or the patient see all the objects in a room but neglect the left half of each individual object [allocentric neglect]. These two broad categories may be further subdivided. Patients with egocentric neglect may ignore the stimuli leftward of their trunks, heads or retinae. Those with allocentric neglect neglect the true left of a presented object or first correct in their mind's eye a slanted or inverted object and then neglect the side which is interpreted as being on the left.

For example: 1] If patients are presented with an upside-down photograph of a face, patients mentally flip the object right side up and then neglect the left side of the adjusted image.

2] If patients are presented with a barbell, they neglect the left side of the barbell more significantly as expected with right temporal lobe lesion. A patient looking at a mirror image of a world map, neglect to see the western hemisphere despite of inverted placement is on the right side of the map.

The Practical Problem of Spatial Neglect

Spatial neglect is a debilitating neurocognitive disorder associated with longer hospitalization, worse rehabilitation outcomes in stroke survivors, higher fall risk and unsafe navigation while walking and using a wheelchair. This disorder is characterized by a failure or slowness to respond, orient, or initiate action towards contra-lesional stimuli and is accompanied by functional disability. Literature suggests that 30 to 70 % of right-brain-damaged stroke survivors present have spatial neglect and 20 to 60 % of left-brain damaged stroke survivors also have spatial neglect. This large variance is a problem to assess and to diagnose hemi spatial neglect disorder. One of the sources to diagnose spatial neglect is there is large variability in the assessments used in its diagnosis: Menon and Korner-Bitensky identified 28 standardized and 34 non-standardized neglect assessment tools, including behavioral tests and functional assessments. Thus, some assessments may fail to detect specific aspects or subtypes of neglect. As a result, research suggests that assessment with more than one behavioral test is helpful to detect the disorder, investigate subtypes, differentiate various mechanisms of spatial Neglect, and to assess both clinical signs and real-world function, especially treatment. Neglect assessment may not be employed due to perceived barriers in the implementation of the assessment. Clinical practice has not respected a consistent standard because some practitioners use behavioral tests e.g. target cancellation, figure copying], document clinical observations, and other practitioners give the judgments about the presence and treatment of neglect based on a general evaluation rather than any specific cognitive testing. This inconsistent practice standard may contribute to the low detection rate of spatial neglect in medical and rehabilitation settings [7].

Diverse interventions for neglect

Several interventions aimed at reducing neglect symptoms have been described, like visual scanning training, prism adaptation, limb activation training, and non-invasive brain stimulation techniques.

Visual scanning techniques

Visual scanning training was originally introduced by Diller and Weinberg [1977], further developed and described by Pizzamiglio. This type of training show very limited attention and exploration behavior toward the contralesional hemi space. The aim of training is to improve visual scanning behavior i.e., to encourage neglect patients for active and conscious attention to stimuli on the contralesional side. In the original training protocol, four standardized training tasks are used, i.e., a computerized digit detection task projected on a large screen, figure copying, picture exploring, and reading and writing tasks. Contralesional exploration behavior is encouraged by means of operant conditioning techniques i.e., reinforcement of correct scanning movements and repeated training of the use of compensatory strategies [for instance using a contralesional anchor and systematically starting to scan from this point and controlling one's performance starting from the contralesional side before finishing an activity [8].

PRISM Adaptation as Promising Treatment for Improving Adaptive Action:

Fortunately, a very promising treatment for neglect, prism adaptation, targets motor-intentional impairment and its neuro-anatomical pathways, with long-lasting rehabilitative effects potentially lasting months to years. During prism adaptation treatment, individuals don prisms that displace their vision rightward and repeatedly perform a visually-guided, goal-directed action for approximately 20 min. Individuals initially make errors in the direction of the visual displacement, but with repeated trials, become more accurate. Once the prisms are removed, adaptation is demonstrated by an aftereffect in which individuals make errors in the direction opposite the prism shift. For stroke survivors with left neglect, Adapting to right-shifting prisms produces a leftward movement shift—they now make movements in the previously neglected left hemi-space. The benefits of prism adaptation extend to dressing, postural

stability, walking, sit-to-stand transfers, and wheel-chair driving.

Prism adaptation appears to exert its rehabilitative effects via action on the spatial-motor system. While ''Where'' perceptual-attentional unawareness is considered the hallmark of neglect, motor-intentional Aiming errors—also observed in spatial neglect—may be directly relevant to functional recovery. Fortis administered two days of Prism adaptation to five right-brain-damaged participants with spatial neglect. A computerized line bisection task allowing for separate quantification of Where and Aiming errors demonstrated that all participants experienced improvement in spatial Aiming bias after prism adaptation, with no reliable improvement in perceptual-attentional Where errors. Furthermore, patients with spatial Aiming bias at baseline make greater functional gains after prism adaptation than those with only where bias. In neglect, even a single session of prism adaptation leads to bilateral increases in task-specific activity in the middle frontal Gyrus and superior parietal lobule. Thus, prism adaptation produces adaptive brain changes, potentially counteracting the bilateral hypoperfusion of frontal and parietal structures associated with unilateral lesions and neglect. However, left and right medial temporal structures may mediate prism adaptation's effects on neglect symptoms. Nonetheless, with both left and right hemispheres participating in spatially-tuned movement, bilateral increase in brain activity suggests prism adaptation may effectively modulate this system. [9].

Limb Activation Treatment [LAT]:

Limb activation treatment consists of the joint activation of spatio-motor brain maps that enhance conscious representation of specific spatial sectors. Robertson and North empirically tested this assumption by asking LN [Left Neglect] patients to perform voluntary movements with their contralesional hemi body. The most important finding of the first studies that investigated the effects of LAT was that a significant reduction of LN signs occurred only when two conditions were concurrently satisfied: a voluntary movement of the contralesional limb, performed in the contralesional space. The same result was observed even when a patient could not see his own moving hand, suggesting that the positive effects of the left-limb movement could not be ascribed to the fact that the left limb acted as a visual cue. In fact, visual cues are known to reduce LN, but they seem not to be as effective as active movements of the contralesional limb. It is also worth to mention, however, that even passive contralesional limb movements can improve LN signs. The relevance of Robertson and North's studies is undoubtedly remarkable. Nonetheless, the fact that only partially positive results of the application of LAT were observed in subsequent group studies has raised some still unsolved questions about the effectiveness of LAT. [10].

TREATMENT:

Non-invasive brain stimulation:

The use of non-invasive brain stimulation is to improve impaired cognitive process in neurologically impaired patients. Transcranial Magnetic Stimulation [TMS] and Transcranial Direct Current Stimulation [TDCS] have been used to ameliorate the symptomatology of patients with visuospatial disorders. TMS is a non-invasive procedure that uses magnetic fields to stimulate nerve cells in the brain to modulate cortical activity. TDCS is a form of neuro stimulation that uses constant, low direct current delivered via electrodes on the head. NIBS is useful to describe the network of attention involved in visuospatial neglect and to clarify the concept of inter hemispheric rivalry. Patients with neglect for easy identify is not necessary and patients with moderate to severe neglect show a number of behaviors [11].

Pharmacological therapies:

It includes two classes of drugs for their potential therapeutical effect in the rehabilitation of neglect: Dopaminergic drugs and Noradrenergic drugs. Dopamine and noradrenaline play essential role in attention, thinking, maintaining alertness, increasing focus and sustaining thought and cognitive effect. Pharmaceutical treatment have mostly focused on dopaminergic therapies such as bromocriptine, levodopa, and amphetamines helping in some cases.

Optokinetic stimulation:

Optokinetic stimulation uses movement on a large visual display to change a patient's perception of where their body is in space with the assumption that they will try to reorient themselves based on this visual information, significant improvement on reading and writing tasks.

Galvanic- vestibular Stimulation:

GVS is the electrical stimulation of vestibular system achieved by placing electrodes in a patient's mastoid processes.

Proprioceptive stimulation:

Proprioceptive stimulation uses both active and passive movement of the contra lesional paretic limb, which reduces the neglect for stimuli in the contra lesional space and neglect is often produced by massive strokes.

Mental imagery training:

Visual and motor imagery exercises can be used in individuals with neglect to improve Contra lesional space exploration as well as arm sensation and copying/drawing performance on neglect tests. This can be achieved by having patients mentally practice positions and movements of the contra lesional upper limb.

REHABILITATION APPROACH:

These approaches are divided into two classes:

1] Rehabilitation procedure based on top down mechanism.

The top down mechanism is a goal directed, such as attention, when knowledge and expectations are used as a guide. A variety of visual scanning procedures designed to improve the recovery and obtained an amelioration of patient's performance in many classical neuropsychological tests as well as in the send structural scale.

2] The bottom up mechanism.

The bottom up mechanism is the stimulus driven and is more of a structural approach, used sensory stimulation to enhance the representation of the contra lesional space. The procedure benefitted more from the earlier mechanism because the patient did not have to be aware of their difficulty and have a voluntary control over the contra lesional space. [12].

Virtual reality:

Virtual reality is an advanced form of human computer interface. With the virtual reality technology, the user is immersed in a rich, multimodal, 3D world. Computer generated virtual reality environments are interactive and realistic with parameters and applications within the environment that are easily controlled and thus allow for training in a safe and cost effective way. Virtual reality techniques are designed to improve motor function rather than cognitive function or activity performance. [13].

Mirror neuron therapy:

Mirror neuron system based therapy has been employed to treat stroke induced movement disorders. Mirror neuron will fire both when executing the movement [example- hand movement] and observing the same movement. Therefore it is an important neural substrate, language learning and empathy. It is proposed that activation of mirror neuron therapy led to brain plasticity, potentially mediated by glutamatergic and neurotrophic mechanisms. In addition right inferior parietal lobule belongs to the mirror neuron system, the activation of which might facilitate the functioning of this brain region and therefore improve the relative spatial perception or attention function. Moreover, it is important to measure severity of neglect is increasing [14].

SCALES TO CHECK PATIENT'S ACTIVITIES

Functional Independence Measure [FIM™]

The FIM consists of 18 items assessing level of independence. The motor domain includes 13 items in the categories of self-care, bladder and bowel management, transfers, and mobility; and the cognition domain includes 5 items in comprehension, expression, social interaction, problem solving, and memory. OTs scored each FIM item using the instructions in the Patient Assessment Instrument [IRF-PAI] Training Manual. Each item is scored from 1 to 7, with higher scores indicating better function. Final scores ranged from 18 to 126.

Barthel Index [BI]

The BI consists of 10 items. The range of scores is different for each item: feeding, bathing, grooming , dressing , bowels , bladder, toilet use, transfers – bed to chair and back , mobility on level surfaces and stairs .The total score is the sum of the 10 items and ranges from 0 to 100, with higher scores indicating better function. [15].

Kessler Foundation Neglect Assessment Process [KF-NAP™]

Kessler Foundation Neglect Assessment Process [KF-NAP™] 2014 Manual provides detailed scoring methods and instructions for using the Catherine Bergego Scale. The 10-category scale is based on observations of patients' everyday life activities that may be affected by spatial neglect. KF-NAP™ can be administered in multiple settings, including the patient's home, an inpatient clinic, an outpatient clinic, an acute care hospital setting, or a subacute facility. The purposes of the KF-NAP™ are:

1] To assess symptoms of spatial neglect in activities of daily living [ADLs]

2] To assist predicting functional outcomes after a brain damage, such as stroke or traumatic brain injury, in the context of comprehensive clinical evaluation.

In addition to the clinical purpose, the KF-NAP™ can be used as an outcome measure in research studies. Behaviors observed in the KF-NAP™ are related to spatial locations in the personal space [i.e., in/on/of one's body surface], the peri personal space [i.e., within arms' reach], the extra personal space [i.e., beyond arms' reach], and the mental space [i.e., the space and location information in memory]. [16].

The Possible Solution: CBS

To bridge the gap between the actual and best clinical practices, rehabilitation clinicians need successful strategies for knowledge translation and practice

reform. With the goal of increasing the clinical use of neglect assessments, we advocate for using a functional assessment for spatial neglect — the Catherine Bergego Scale [CBS]. Of the existing standardized assessments CBS is the only one assessing performance in personal [body parts or on the body surface], peri-personal [within arm's reach] and extra-personal spaces [beyond arm's reach], as well as in perceptual, representational, and motor domains. Thus, the CBS captures the heterogeneity of the neglect disorder. Additionally, the CBS assessment occurs via direct observation of spontaneous [i.e., self-initiated] behaviors in 10 everyday activities, such as brushing hair on both left and right sides and remembering to take care of the left limb that may be weaker and hanging outside the wheelchair. In contrast, a laboratory-based or paper-and-pencil behavioral examination usually requires patients to follow instructions to perform a task seldom encountered in daily life, which may be sensitive in detecting lateralized bias but not directly translatable to functional disabilities. Commonly used activity-of-daily-living [ADL] measures, such as the Barthel Index [BI] and the Functional Independent Measure [FIM], do not directly assess the impact of spatial neglect versus other disabling impairments. Even though the presence of spatial neglect, detected by behavioral tests, is significantly correlated with BI or FIM, the CBS directly measures neglect-related limitation on activity and participation. Therefore, the CBS has the ability to assess ADLs that are directly related to spatial neglect, to provide clinicians with a more precise description of a patient's ability and disability, and to represent a useful and efficient tool in evaluating rehabilitation efficacy. [17].

FURTHER CHALLENGES

- **Approach the neglected side:** Encourage staff and visitors to always sit on the affected side of the person with Neglect. Hold the persons hand on the affected side to draw their attention to that side. [18].
- **Place objects on the neglected side**: Placing the phone, television remote control, glass of water or other necessities on the neglected side encourages them to look and reach for objects on that side. The more he acknowledges that side, the more likely he will be able to eventually perceive it.
- **Guide the neglected hand:** When the person isn't aware of an object on his neglected side, what we can do is take their hand in ours and guide it to the object; by this their hand automatically turns in that direction and their eyes follows.

REFERENCES:

1) Stone SP, Wilson B, Wroot A, et al. The assessment of visuo-spatial neglect after acute stroke. J Neurol Neurosurg Psychiatry 1991
2) Beschin N, Robertson IH. Personal versus extrapersonal neglect: a group study of their dissociation using a reliable clinical test. Cortex 1997
3) Zoccolotti P, Judica A. Functional evaluation of hemineglect by means of a semistructured scale: personal extrapersonal differentiation. Neuropsychol Rehab 1991.
4) Denes G, Semenza C, Stoppa E, et al. Unilateral spatial neglect and recovery from hemiplegia: a follow-up study. Brain 1982.
5) Mesulam M-M. Spatial attention and neglect: parietal, frontal and cingulate contributions to mental representation and attentional targeting of salient extrapersonal events. Phil Trans R Soc Lond B 1999.
6) Robertson IH. Do we need the ''lateral'' in unilateral neglect? Spatially nonselective attention deficits in unilateral neglect and their implications for rehabilitation. Neuroimage 2001.
7) Husain M, Rorden C. Non-spatially lateralized mechanisms in hemispatial neglect. Nat Rev Neurosci 2003
8) Rossetti Y, Rode G, Pisella L, et al. Prism adaptation to a rightward optical deviation rehabilitates left hemispatial neglect. Nature 1998.
9) Azouvi P, Samuel C, Louis-Dreyfus A, et al. Sensitivity of clinical and behavioural tests of spatial neglect after right hemisphere stroke. J Neurol Neurosurg Psychiatry 2002.
10) Ferber S, Karnath H. How to assess spatial neglect – line bisection or cancellation tasks? J Clin Exp Neuropsychol 2001.
11) Denis M, Beschin N, Logie R, et al. Visual perception and verbal descriptions as sources for generating mental representations: evidence from representational neglect. Cogn Neuropsychol 2002.
12) Muller-Oehring EM, Schulte T, Kasten E, et al. Distractor dependent visual search performance in patients with neglect and hemianopia. Soc Neurosci 2002
13) Vuilleumier P, Sagiv N, Hazeltine E, et al. Neural fate of seen and unseen faces in visuospatial neglect: a combined event-related functional MRI and event-related potential study. Proc Natl Acad Sci USA 2001.
14) Farne A, Rossetti Y, Toniolo S, et al. Ameliorating neglect with prism adaptation: visuo-

manual and visuo-verbal measures. Neuropsychologia 2002
15) McIntosh RD, Rossetti Y, Milner AD. Prism adaptation improves chronic visual and haptic neglect: A single case study. Cortex 2002.
16) Robertson IH, Mattingley JB, Rorden C, et al. Phasic alerting of neglect patients overcomes their spatial deficit in visual awareness. Nature 1998.
17) Jakala P, Riekkinen, Sirvio J, et al. Guanfacine, but not clonidine, improves planning and working memory performance in humans. Neuropsychopharmacology 1999
18) Grujic Z, Mapstone M, Gitelman DR, et al. Dopamine agonists reorient visual exploration away from the neglected hemispace. Neurology 1998