

# Rehabilitation in Perceptual disorders in stroke patients

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## Abstract

Stroke is the one of commonest leading cause of death and early intervention following stroke may lead to better outcomes post stroke. The prevalence of perceptual disorders is generally 38% as per recent literature. Perceptual deficits need better understanding of its occurrence, systematic evaluation and proper diagnosis skills to pick it up in the early stages of disease. There is Poor level of evidence of rehabilitation of these deficits hence more research is required in this component of stroke as these deficits might hinder the progress of stroke.

**Keywords:** Stroke, rehabilitation, perception, recovery, perceptual disorders

## Introduction

Stroke is defined as a sudden alteration in neurological function caused by interruption of the blood flow to the brain. There are many new interventional advances in the recent years which lead to a reduction in the morbidity or mortality of stroke if diagnosed and treated in the early hours of stroke onset. The recent Advances in the field of Neurorehabilitation have also been instrumental in reducing the morbidity associated with stroke. In India and many other developing countries lacks basic care and early intervention to these patients. The key would be to provide uniform awareness across the world with early intervention including thrombolysis in therapeutic window and provide long term neurorehabilitation post acute care.

World Health Organization defines stroke as 'a rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin<sup>1</sup>. The WHO definition<sup>1</sup> is focusing mainly on the clinical aspects. The Stroke Council of the American Heart Association/American Stroke Association defined central nervous system infarction as brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. The updated definition of stroke incorporates clinical and tissue criteria and can be incorporated into practice, research, and assessments of the public health. (Stroke. 2013)

Reports from around the world suggest that stroke is the commonest cause of death, second to coronary artery disease. Stroke is the commonest diagnosis which is seen in chronic adult disability. One in every 6 men and one in every 5 women are at a risk of developing stroke after 55 years of age. Recent literature suggests that approximately 80% of all stroke cases occur in developing countries<sup>2</sup>. The prevalence of stroke in India is 1.27 to 2.20 per 1,000 persons and incidence rate of stroke in India is 148 per 100,000 persons (95% CI, 120-170)<sup>3</sup>.

The lack of progress in patients who have sustained brain damage is chiefly due to presence of cognitive and perceptual deficits. Perceptual deficits are some of the most puzzling and disabling difficulties that a person can experience. Many studies have reported that people suffering from these difficulties may not be able to live alone, fulfill the responsibilities of paid employment, or maintain a family life and relationships. Thus treating these people with perceptual disability depends mainly on understanding and detecting these disabilities in them. Patients who suffer from stroke and traumatic brain damage are at the highest risk of groups which acquire perceptual disabilities<sup>4</sup>. Often perceptual deficits are missed in the initial sensory-motor testing. Awareness of the possibility and nature of the deficit will help in treating the said deficit in the early stages.

Perception can be defined as our recognition and interpretation of sensory impressions and integrating them into information that is psychologically meaningful<sup>5</sup>. To explain perception in common terms it is how we channelize the sensory information from the surrounding and use it while interacting with the surrounding environment. Perception also means in what way a person can react to any information available from the surrounding.

In most of the centers for rehabilitation in India and other developed country, the practice of Multi-disciplinary team approach for stroke rehabilitation is not implemented. This leads to many cases of Perceptual disorders being under diagnosed or treated with conventional therapy. As evident by recent literature the persistence of unilateral neglect leads to poor motor recovery and increase risk of falls, it's necessary for any one working in the field of Neuro-rehabilitation, to identify perceptual impairments in stroke survivors and treating them with available newer therapeutic approaches to enhance motor recovery.

The common perceptual disorders seen are unilateral neglect, anosognosia, apraxia, asomatognosia & agnosia. This article highlights important perceptual deficits seen in stroke patients, it addresses each deficit under the following headings, Definition, Area of affection, Recent advances in diagnosis of the deficit, rehabilitation option and future scope of research in the deficit.

## 1. Unilateral Neglect

Unilateral Neglect is a deficit of attention and is described as the inability to report, respond, or orient to sensory or visual stimuli when it appears on the side opposite to the lesion<sup>6</sup>. It is also referred to as unilateral spatial neglect, hemi-inattention, hemi-neglect, and unilateral visual inattention<sup>8</sup>. This is a frequent symptom post stroke; there is an inability to respond to any stimulus given in the contralesional hemispace (25-30% of all stroke patients. In 40% of patients, neglect does not recover after one year and becomes chronic.)<sup>7,8,9</sup>

### Example

The patient may ignore the left half of the body when dressing and forgets to put on the left sleeve or left pants leg. Often a male patient will forget to shave the left half of his face. A woman may neglect to put make up on left side of his face. The patient may neglect to eat from the left half of the plate and will start reading a newspaper from the middle of the line. Typically, the patient bumps into objects on the left side or tends to veer towards the right when walking or propelling a wheelchair.

### Area of affection

Unilateral neglect as a symptom post stroke is seen when the lesion areas involve the inferior- posterior regions of the right parietal lobe or temporo-parietal junction<sup>10, 11</sup>. In recent literature, few authors have suggested that lesion of the right superior temporal gyrus, sub cortical lesions involving the thalamus and basal ganglia, posterior cortical and frontal regions are associated with the pathogenesis of unilateral neglect<sup>12,13,14,15</sup>.

### Clinical diagnosis

In major stroke, unilateral neglect can be seen in the acute stage when the patient avoids his left side of body, which might improve overtime. In the chronic stage, patient is observed during his activities of daily living (ADLs) such as grooming and dressing or during instruments of daily of living such as preparing a meal. The medical professional observes the behavior and changes in response to cueing.

There are certain outcome measures which may be used to assess the change in neglect over time, they are follows-

#### 1. Bells test:

This test allows for an overall assessment of visual neglect in the near extrapersonal space. It is a reliable and valid measure to assess both quantitative and qualitative aspects of unilateral neglect<sup>16</sup>.

#### 2. Clock Drawing test (CDT)

This test may help to identify the attention and executive dysfunctions associated in a patient with unilateral neglect. It is a reliable as well as valid measure. (ranging from 0.92-0.97)<sup>17</sup>.

### **3. Behavioral Inattention Test**

These tests are used to assess the presence and the extent of visual neglect. It is a reliable as well as valid measure<sup>18</sup>.

#### **Rehabilitation of Unilateral Neglect**

Rehabilitation of Unilateral Neglect consists of two major goals,

1. Improving the attention to neglected side,
2. Improving Proprioceptive and Kinesthetic sensations.

Recent trends in rehabilitation of Unilateral Neglect has the following techniques, namely Visual scanning<sup>19</sup>, Transcranial Magnetic Stimulation (TMS)<sup>20</sup>, Optokinetic Stimulation<sup>21</sup>, Neck muscle Vibration<sup>22</sup>, Vestibular stimulation<sup>23</sup>, Limb activation training<sup>24</sup>, Mental Imagery training<sup>25</sup>, Eye patching<sup>26</sup>, Virtual Reality<sup>27</sup>, TENS<sup>28</sup> and Mirror therapy<sup>29</sup>. Many of these rehabilitation techniques are not available in India and developing countries at present, therefore future studies are required to guide the superiority of the different techniques and even combination therapy.

**Level of evidence** for unilateral neglect is 2b

#### **Future scope and recommendation for better evidence**

Identification of any visual field deficits in stroke patients at the earliest, with reporting the characteristics of the neglects should be encouraged in further studies. Proper construction of methodology for randomized control trials with a significant sample size is the need of the hour to improve the level of evidence. Follow up across a longer timeline would help in identifying the lasting effects of different interventions for unilateral neglect are also necessary.

## **2. Anosognosia**

Anosognosia is defined as lack of awareness, denial, of a paretic extremity as belonging to the person, or a lack of insight concerning or denial of paralysis. Characteristics include unawareness of motor impairment & disability associated following the impairment<sup>30</sup>.

There is poor outcomes seen in these patients when compared to others as the patient has a strong belief there isn't anything wrong with them, this leads to non compliance to rehabilitation interventions and leads to increase risk of injury to the patient.<sup>30,31</sup>

#### **Example**

The patient maintains a strong belief that there is nothing wrong with him/her and may disown the paralyzed limb and claim it to be foreign.

#### **Area of affection**

Anosognosia is seen most commonly in patients with lesions in the fronto-parietal or parieto-temporal areas, where Supra-marginal gyrus is mainly involved<sup>32,33</sup>.

#### **Clinical Diagnosis**

There will be discrepancy in the History, Examination, Attitude and Complaints of the patient which hints towards the diagnosis. They may deny the paralysis, say that it is of no concern, and fabricate reasons why a limb does not move the way it should.

#### **Rehabilitation measures**

Anosognosia is a neglected area of research when it comes to investigating the rehabilitation interventions used to treat them<sup>34</sup>. Literature suggests the use of vestibular stimulation in the treatment of anosognosia is present, but proper guidelines or structured rehabilitation plan are not evident<sup>35</sup>.

A new approach of Self-determination and comprehensive dynamic interactional model of awareness are used to enhance self awareness have been reported to have an effect of anosognosia post stroke<sup>36</sup>.

**Level of Evidence** for anosognosia is 3(a)

### **Future scope of research**

Anosognosia is a complex, multifaceted impairment which leads to significant hindrance in activities of daily living. Multidimensional interventions are required to address the various components associated with this syndrome. Developing patient tailored combination therapeutic approaches that address the components needs to be developed. Development of Protocols and High quality RCTs to improve the level of evidence to treat patients with anosognosia is the need of the hour.

## **3. Asomatognosia**

Asomatognosia is a neurological disorder characterized as loss of recognition or awareness of part of the body<sup>37</sup>. The patient for instance will fail to acknowledge the limb, citing it to be an alien limb. Somatoparaphrenia is an associated delusional condition in which the patient addresses the limb as another person, it is milder and easily correctable<sup>38</sup>.

### **Example**

The patient doesn't recognize his own hand after an incident of stroke; they may end up causing trauma to the alien hand.

### **Area of affection**

In patients with asomatognosia there is involvement of the right parietal mainly. Recent literature suggests being an additional involvement of the temporoparietal and medial frontal areas as well. Distinguishing between somatoparaphrenia and asomatognosia lies in the involvement of orbitofrontal area in the former<sup>39</sup>.

### **Clinical Diagnosis**

History provided by the family, after which patient is requested to point to body parts called by the physician, on him/herself, on the examiner and on a picture or puzzle of a human figure and Imitate movement of the examiner.

### **Rehabilitation**

As asomatognosia is usually only a transient disorder after stroke and slow recovery is seen over time, these patients are associated with other neurological and cognitive disorders that are the main target of rehabilitation. However, we are not aware of any rehabilitative study specifically aimed at disorders of the body schema. There is no study specifically aimed at disorders of the body schema, however constraint-induced movement therapy have been proved to be efficient even for associated non-motoric disorders.

Some of the newer rehabilitative techniques that have been reported to improve asomatognosia are as follows

**1. Vestibular caloric stimulation<sup>40</sup>** consists in irrigating the contralesional external ear canal with cold water for one minute (60 mL, 20°C). The effects are often dramatic, as this can entirely eliminate for a few minutes a longstanding anosognosia, hemineglect, or somatoparaphrenia.

**2. Adaptation to prismatic deviation<sup>41</sup>** In this, the patient has to wear special lenses that induce a deviation of the whole visual field towards the ipsilesional side. During this time, they progressively adapt to the deviation by correcting motor movements in a pointing task towards the contralesional side.

**3. Using mirrors<sup>42</sup>** can be a way to investigate the effects of indirect visual feedback on one's body schema. Such an approach may improve or impair somatognosia, for reasons not yet understood. These approaches, together with behavioral neurology, psychopathology and cognitive neuroscience, will hopefully shed new lights on this disabling deficit.<sup>43</sup>

**Level of evidence** for asomatognosia 2(c)

## Future Scope of Research

More randomized control trials are needed to give guidelines for the best technique for rehabilitation including newer technology. Imaging and cellular study should be done to have a better understanding of the pathogenesis.

## 4. Agnosia

Agnosia is the inability to process sensory information. Often there is a loss of ability to recognize objects, persons, sounds, shapes, or smells while the specific sense is not defective nor is there any significant memory loss.<sup>44</sup>

### Types of Agnosia

- A. Visual agnosia-** Visual object agnosia is the most common type of Agnosia. It is defined as the inability to recognize familiar objects without any abnormality in of eyes or optic tracts.
- B. Auditory agnosia-** Auditory agnosia refers to the inability to recognize non-speech sounds or to discriminate between them. This rarely occurs in the absence of other communication disorders.
- C. Tactile agnosia-** Tactile agnosia is the inability to recognize forms by handling them, although tactile, proprioceptive, and thermal sensations may be intact.

### Examples

- A. Visual agnosia- it is not possible for the patient to recognize familiar people, possessions or common objects.
- B. Auditory agnosia- it is not possible for the patient to differentiate the ring of a telephone and doorbell.
- C. Tactile agnosia- It is difficult for the patient to recognize any object presented to him/her when eyes are closed.

### Area of affection

Visual agnosia- Right Lateral Fusiform Gyrus <sup>45</sup>.

Auditory agnosia- Dominant anterior superior temporal gyrus of the auditory pathway <sup>46</sup>.

Tactile agnosia- Parietal lobe or dorsal column or parieto-temporo-occipital lobe of right or left hemisphere of the cerebral cortex <sup>47</sup>.

### Clinical Diagnosis

- A. Visual agnosia- When various familiar things are kept in front of the patient and asked to identify it he fails to do so.
- B. Auditory agnosia- The patient fails to identify or differentiate various auditory stimuli.
- C. Tactile agnosia- The patient fails to recognize familiar objects when eyes are closed.

### Rehabilitation

#### *Visual agnosia*<sup>48</sup>

There are very few studies done for rehabilitation of visual agnosia, it is yet in the evolving stage. Compensatory strategies and restorative training have been studied in recent literature with the former showing positive results and later showing questionable results.

#### *Auditory agnosia*<sup>49</sup>

Lip reading and communication technique has been useful in rehabilitation of auditory agnosia. Drilling the patient on sounds to help differentiate them has been practiced but not proven to be useful.

#### *Tactile agnosia*<sup>50</sup>

Faber's approach for rehabilitation of tactile agnosia has been very useful in adults and children which comprises of manipulation of an object in both hands with sequential visual stimulus and without visual stimulus.

Level of evidence for agnosia is 2©

### **Future Scope of research**

The evidence available for interventions in agnosia has been largely attributed to single case studies. A more detailed rehabilitation plans are needed to be developed for treating different types of agnosia to provide a universal approach of treatment.

## **5. Apraxia**

Apraxia is defined as a cognitive motor planning disorder leading to an inability to perform actions in the absence of weakness or sensory loss<sup>51</sup>.

**Ideomotor apraxia**<sup>52</sup> (Ideokinetic) is an inability to plan or perform a motor skill. The patient fully comprehends the motion asked to be demonstrated, he will even be able to explain the motion but when he initiates the motion, he cannot perform the motion. The task may be performed spontaneously but is difficult when asked to demonstrate.

**Ideational apraxia**<sup>53</sup> is an inability to comprehend the concept of the movement or to execute the act in response to a command or automatically. The patient is unable to comprehend the motion asked to be demonstrated, he won't be able to explain the motion and won't be able to perform the movement.

According to a study, the prevalence of apraxia following stroke is 1/3 of the patients in rehabilitation centers and nursing homes following left brain injury<sup>54</sup>.

### **Area of affection**

Injury to the left frontal and parietal areas of the brain leads to apraxia post stroke<sup>55</sup>.

### **Clinical Diagnosis**

For the diagnosis of apraxia there are various screening tools that are available, they are follows AST – Apraxia Screen of TULIA, CAS – Cologne Apraxia Screen. For Research/scientific purposes the following screening tools can be used, Apraxia test by Alexander et al, Test Battery by Bartolo et al & The Florida Apraxia Battery & Revised Sydney (FABERS).

### **Rehabilitation**

Breaking down movements into small components is essential; each step is taught separately and practiced many times. The use of tactile and proprioceptive cues has been proven to be helpful. Recent literature proves use of visual and auditory feedback has been proven to be ineffective for treatment of apraxia. Once the small tasks are learnt separately the clinicians begins to combine certain steps and thereby steadily increases the complexity of the movement pattern.

### **Future scope for research**

More randomized control trials are needed to give guidelines for the best technique for rehabilitation including newer technology. Imaging and cellular study should be done to have a better understanding of the pathogenesis.

## **Summary**

Perceptual disorders are not easily recognized by the clinicians hence they lead to poor outcomes in stroke. These deficits are transient but may lead to increase risk of falls and injury to the affected part. Hence early recognition by a clinician is necessary. There is no uniform rehabilitation plan as the level of evidence is poor; based on the traditional foundation of rehabilitation newer, cost effective techniques need to be developed in a systematic way so as to improve the quality of life of patients post stroke.

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