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Original Article

Relationship between side of hemiparesis and functional independence using activities of daily living index

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ABSTRACT

Introduction: Stroke is the third most common cause of death in the Western Hemisphere and the most common cause of adult disability and balance problems. The purpose of this study was to find the relation between dependency of performing functional activities of daily living (ADL) with side of hemiparesis in patients with stroke using Barthel Index.

Methods: This was a study of 130 patients with onset of first stroke in their life. Barthel (ADL) Index was used to assess functional ability and independence of stroke patients. The Barthel Index consists of 10 items assessing the ability to achieve certain activities without assistance. This scale gives a score between 0 and 20 in one point increments. The top score of 20 implies functional independence (slight dependency), not necessarily normality. Patients were divided into 5 categories according to their score: totally dependent (0–4), severely dependent (5–9), moderately dependent (10–14), mildly or slightly dependent (15–19) and independent (20). Then, we analyzed the results to find the relation between side of hemiparesis and functional independence.

Results: Of 130 patients with stroke, 61 patients were having right-sided hemiparesis and 69 had left sided. Out of 69 patients with left-sided hemiparesis, 16 were independent (mildly and moderately dependent) and out of 61 with right-sided hemiparesis, 35 were independent (mildly and moderately dependent). Cross tabulation and chi-square tests revealed significant relationship between side of hemiparesis and functional independence in patients with stroke ($\chi^2 = 18.779$, $p < 0.001$). Phi-square test value (0.380) is also significant ($p < 0.001$).

Discussions: This suggests that side of hemiparesis/weakness could be taken into consideration as a factor in functional independence assessment and further retraining of hemiparetic stroke survivors. Strong relationship exists between side of hemiparesis and functional independence in patients with stroke.

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1. Introduction

Stroke is the third most common cause of death in the Western Hemisphere and the most common cause of adult disability; of the survivors, about 50% will have a significant long-term disability.[1] Balance problems are thought to be common after stroke, and they have been implicated in the poor recovery of activities of daily living (ADL) and mobility and an increased risk of falls.[2–5]

Stroke often results in impaired balance. Balance is essential for optimal functioning of the locomotor system and the performance of many activities of daily living. Accurate evaluation of balance is important for prescribing appropriate mobility aids, determining the most effective treatment interventions, and identifying safe and unsafe activities after stroke. Because balance changes over time after stroke, it is also important to have a quantifiable measure that clinicians can use to monitor these changes and adjust treatment accordingly.[6]

Hemiparesis is the most frequent neurological deficit after stroke. Hemiparesis is weakness on one side of the body. Hemiparetic stroke patients frequently present balance abnormalities. Balance problems in hemiparetic patients after stroke can be caused by different impairments in the physiological systems involved in postural control, including sensory afferents, movement strategies, biomechanical constraints, cognitive processing, and perception of verticality.[5,7]

Two main mechanisms result in stroke. Strokes can be ischemic, the result of a thrombus, embolism or conditions that produce low systemic perfusion pressures. The resulting lack of cerebral blood flow (CBF) deprives the brain of needed glucose and oxygen, disrupts cellular metabolism and leads to injury and death of tissues (Infarction). Strokes can also be hemorrhagic, with abnormal bleeding into extra vascular areas of the brain secondary to aneurysm or trauma. Hemorrhage results in increased intracranial pressures with injury to brain tissues and restriction of distal blood flow.[8]

A severe stroke will cause the absence of righting and equilibrium reactions; however, after a mild stroke, these reactions are present but decreased in quality and timing or delayed. Good sitting balance is a prerequisite for functional transfers, standing balance, and ambulation of stroke patients. Visual, proprioceptive, vestibular, and auditory input are important to help a patient regain good sitting balance.[9]

Sitting balance is not a functional activity, but the ability to maintain or attain sitting balance is believed to be necessary to perform functional activities such as dressing and transferring and eating in a seated position. Sitting balance is a crucial component to perform ADL.[10–13] Some studies have found that sitting balance at an early stage could predict activities of daily living outcome at a late stage in patients after a stroke.[10–15]

Outcome of mobility one year after stroke can be predicted validly by including functional status, sitting balance, moment of admission to the rehabilitation centre after stroke onset and age.[16]

Age, sitting balance and bowel control were predictive factors for the walking item of the Barthel Index (BI) at discharge from the hospital.[16]

The Barthel Activities of Daily Living Index is used to assess the functional ability and independence of chronically ill patients with neuromuscular or musculoskeletal disorders during inpatient rehabilitation. It comprises scores for feeding, mobility, personal care, ambulation or wheelchair skills, bowel and bladder abilities, and dressing skills.[17]

In this paper we present a study aimed at providing evidence concerning interhemispheric differences in controlling the functional independence of patients with stroke, not only for simple motor functions but also for the patient's ability to achieve those functional motor skills which are part of the normal behavior necessary for an individual to function independently in our society.

2. Materials and methods

This study was performed on 130 patients having right-sided dominancy with stroke and hemiparesis. Patients were recruited from the Department of Neurology, Sir Sunderlal Hospital, Banaras Hindu University, Varanasi according to inclusion and exclusion criteria after signing the informed consent form. Inclusion criteria: (1) Confirmed diagnosis of hemiparesis secondary to first cerebrovascular attack in their life. (2) Medically stable and able to give informed consent. (3) No other documented vestibular, orthopedic disorder and previous motor disability that can affect balance. (4) Both genders included. (5) Stroke onset within 7 days before assessment. We excluded volunteers if they had Subarachnoid hemorrhage diagnosed using laboratory tests, unable to understand simple verbal instructions or having Mini Mental Status Examination (MMSE) <23 and subjects taking any drugs currently causing dizziness, drowsiness and light headedness.

2.1. *Instruments*

2.1.1. *Barthel (ADL) Index*

Barthel (ADL) Index was used to assess functional ability and independence of stroke patients. The Barthel Index consists of 10 items assessing the ability to achieve certain activities without assistance. It evaluates the ability of feeding, moving from wheelchair to bed and returning, doing personal toilet, getting on and off toilet, bathing self, walking on level surface, ascending and descending stairs, dressing, controlling bowels and controlling bladder. Scoring ranges from 0 (completely dependent) to 20 (completely independent). Patients scoring 20 points could have abilities ranging from barely being able to perform the activities of daily living to being able to earn a salary in skilled employment. Therefore, patients can continue to improve after scoring 20 points. Similarly, the patient scoring 0 can emerge from a coma and be conscious though helpless in bed without a change in his score. Although abilities of patients with scores at either end of the scale can vary considerably, the functioning of patients with identical intermediate scores differs less. The lower the patient's score, the more severe is his physical impairment; a rise in score indicates an improvement in his physical functioning.[18–20]

2.1.2. Procedure

Patients were recruited from the Department of Neurology, Sir Sunderlal Hospital, Banaras Hindu University according to inclusion and exclusion criteria. Informed Consent form was obtained from each patient to avoid any ethical issue. Sampling method used was purposive non-probability sampling. Complete neurological examination (Table 1) of each subject was done for which we obtained a complete assessment form. We took the Manual Muscle Testing (MMT) Score so that we can come to know the exact state of muscle power of the patients. Assignment of the patients to be hemiparetic was based on the severity of paralysis that is patients having MMT score 2–4. All the radiological medical reports of the patients were analyzed. Side of hemiparesis and type of stroke were determined after studying the reports weather it is hemorrhagic or ischemic stroke. Functional ability and independence of the patients was determined within one week of patients' admission to the hospital by using the Barthel Index for activities of daily living (ADL). This scale gives a score between 0 and 20 in one point increments. The top score of 20 implies functional independence (slight dependency), not necessarily normality. Patients were divided into 5 categories according to their score: totally dependent (0–4), severely dependent (5–9), moderately dependent (10–14), mildly or slightly dependent (15–19) and independent (20). Information about function was recorded for the 24 h before the assessment, and was taken from the best available source (for example, nurses, relatives, and the patient). Patients were not asked to demonstrate ability on each item instead they demonstrated what they do.[19,20]

Table 1 – Complete neurological examination.

<table>
<tr>
<td>NAME-
DATE-
AGE-
GENDER-
HANDEDNESS-
OCCUPATION BEFORE THE ONSET-
ADDRESS-
PNONE NO-.
DATE AND MODE OF ONSET (sudden or gradual)-……
……..</td>
<td>Family history
Similar symptoms among relatives

Vital signs
Temprature
Blood pressure
Respiratory rate</td>
</tr>
<tr>
<td>Complaints
Pain

Weakness</td>
<td>External appliances
Catheter
IV lines
Drainage tubes
Aphasia (expressive, receptive)
Agnosia (visual, auditory)
Anosagnosia</td>
</tr>
<tr>
<td>ADL Difficulty
Ambulation difficulty
Bed activity diffulty
Dressing difficulty
Eating difficulty
Toilet activities difficulty</td>
<td>Cranial nerve examination</td>
</tr>
<tr>
<td>Associating Symptoms

Headache
Nausea
Vomiting
Seizures</td>
<td>Sensory disturbance if any
Motor examination
Normal
Hypotonic
Hypertonic</td>
</tr>
<tr>
<td>Past Medical History
<u>Onset of present illness</u>:
Infection
Fever
Weight loss
<u>History of:</u>
Diabetes mellitus
Hypertention
Trauma/injury
HOSPITALIZATIONS
OPERATIONS
MEDICATIONS

Personal History
<u>Personal habits</u>:
Smoking
Alcohol
<u>Marital status</u>:
Married</td>
<td>MMT Grading
<table>
<tr><th>MUSCLE GROUP</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>Shoulder flexors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Shoulder extensors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Shoulder abductors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Shoulder adductors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Elbow flexors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Elbow extensors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Wrist flexors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Wrist extensors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hip flexors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hip extensors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hip abductors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hip adductors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hip internal rotators</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hip external rotators</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Knee flexors</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
</tr>
</table>

Knee extensors						
Planter flexors						
Dorsiflexors						

REFLEXES

	Absent	Diminished	Normal	Exaggerated
Biceps				
Knee				
Patellar				

MINI-MENTAL STATUS EXAMINATION

Orientation

5 ( ) What is the (year) (season) (date) (day) (month)?

5 ( ) Where are we (state) (country) (town) (hospital) (floor)?

Registration (Immediate memory**)**

3 ( ) Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer.

Then repeat them until he/she learns all 3. Count trials and record.

Trials _____

Attention and Calculation

5 ( ) Serial 7's. 1 point for each correct answer. Stop after 5 answers.

Alternatively spell "world" backward. **WORLD**

Recall (short-term memory**)**

3 ( ) Ask for the 3 objects repeated above. Give 1 point for each correct answer.

Language

2 ( ) Name a pencil and watch.

1 ( ) Repeat the following "No ifs, ands, or buts"

3 ( ) Follow a 3-stage command:

"Take a paper in your hand, fold it in half, and put it on the floor."

1 ( ) Read and obey the following: CLOSE YOUR EYES

1 ( ) Write a sentence.

1 ( ) Copy the design shown.

Total Score - **/30**

THE BARTHEL INDEX

Bowels

0 = incontinent (or needs to be given enemata)

1 = occasional accident (once/week)

2 = continent

Bladder

0 = incontinent, or catheterized and unable to manage

1 = occasional accident (max. once per 24 hours)

2 = continent (for over 7 days)

Grooming

0 = needs help with personal care

1 = independent face/hair/teeth/shaving (implements provided)

Toilet use

0 = dependent

1 = needs some help, but can do something alone

2 = independent (on and off, dressing, wiping)

Feeding

0 = unable

1 = needs help cutting, spreading butter, etc.

2 = independent (food provided within reach)

Transfer

0 = unable – no sitting balance

1 = major help (one or two people, physical), can sit

2 = minor help (verbal or physical)

3 = independent

Mobility

0 = immobile

1 = wheelchair independent, including corners, etc.

2 = walks with help of one person (verbal or physical)

3 = independent (but may use any aid, e.g., stick)

Dressing

0 = dependent

1 = needs help, but can do about half unaided

2 = independent (including buttons, zips, laces, etc.)

Stairs

0 = unable

1 = needs help (verbal, physical, carrying aid)

2 = independent up and down

Bathing

0 = dependent

1 = independent (or in shower)

Total Score:

2.2. *Data analysis*

The data was analyzed by using Statistical Package of Social Science-SPSS software (version 16) for windows. The arithmetic mean and standard deviation of the age of patients was calculated. Relationship between side of hemiparesis and functional (ADL) independence was analyzed using cross tabulation and Chi-Square test was used to find whether the results were statistically significant or not. The strength of this relationship was calculated using phi-square test. The significant level was set at 5% ($p \leq 0.05$).

3. Results

Table 2 summarizes the mean and standard deviation of age of patients and number of patients with hemorrhagic stroke and ischemic stroke. Cross tabulation and chi-square revealed strong relationship between side of hemiparesis and functional (ADL) independence in patients with stroke ($\chi^2 = 18.779$, $p < 0.001$). Phi-square test value (0.380) is also significant ($p < 0.001$).

Of 130 patients, 78 were male and 52 were female and 69 were having left-sided hemiparesis and 61 were having right-sided hemiparesis. Out of 69 patients with left-sided hemiparesis, 16 were independent (mildly and moderately dependent) and out of 61 with right-sided hemiparesis, 35 were independent (mildly and moderately dependent) (Table 3).

4. Discussion

In this study, we investigated the relationship between side of hemiparesis and level of functional independence in ADL. We found that patients with left-sided hemiparesis were more dependent functionally than patients with right-sided hemiparesis. That means patients with right-sided hemiparesis were functionally independent. This suggests that side of

Table 2 – Characteristics of hemiparetic patients whose chart descriptions of functional (ADL) independence were examined.

Type of stroke	Men	Women	Total	Age (Mean ± SD)
Right-sided hemiparesis	36	25	61	56.8 ± 13.7
Left-sided hemiparesis	42	27	69	57.7 ± 13.8

hemiparesis is related to the independence in activities of daily living and can be taken into consideration as a factor in assessment of functional (ADL) independence and further retraining of stroke survivors. M Kotila et al[21] did a study to analyze the influence of different neurological and neuropsychological deficits, as well as the influence of premorbid factors, on the outcomes at specific points in time. They found that patients with right hemispheric lesion did not differ functionally from patients with left hemispheric lesion. Results of this study are not in support with the outcome of our study and the reason might be the measure of ADL assessment as they haven't used any specific and reliable method for ADL assessment while we have used a very reliable and valid scale.

M Kaste and O Waltimo[22] did a study on the Prognosis of patients with MCA (middle cerebral artery) occlusion and they reported that left-sided occlusion of the MCA was more common among those who were able to return to work, and right-sided occlusion among those who required assistance in ADL. Results of this study are in support to that of our study. Marquardsen[23] suggested the reason for this was that the lesions of the right hemisphere affect the functions of visuomotor, temporal and spatial concepts that are responsible maintaining balance and also for a number of functional activities of our day to day life. Our findings are also similar to the findings of Lehman[24] who reported that patients with right hemispheric lesions have less favorable functional outcomes than patients with left hemispheric lesions.

Table 3 – Relationship between side of hemiparesis and functional (ADL) independence.

Barthel Index		Side of hemiparesis		Total
		Right	Left	
0–4 (totally dependent)	Count	14	35	49
	% within BI_score	28.6%	71.4%	100%
	% within side of hemiparesis	23.0%	50.7%	37.7%
	% of total	10.8%	26.9%	37.7%
5–9 (severely dependent)	Count	12	18	30
	% within BI_score	40.0%	60.0%	100%
	% within side of hemiparesis	19.7%	26.1%	23.1%
	% of total	9.2%	13.8%	23.1%
10–14 (moderately dependent)	Count	21	13	34
	% within BI_score	61.8%	38.2%	100%
	% within side of hemiparesis	34.4%	18.8%	26.2%
	% of total	16.2%	10.0%	26.2%
15–19 (slightly dependent)	Count	14	3	17
	% within BI_score	82.4%	17.6%	100%
	% within side of hemiparesis	23.0%	4.3%	13.1%
	% of total	10.8%	2.3%	13.1%
Total	Count	61	69	130
	% within BI_score	46.9%	53.1%	100%
	% within side of hemiparesis	100%	100%	100%
	% of total	46.9%	53.1%	100%

$\chi^2 = 18.8$, $p < 0.001$.
ADL = Activities of Daily Living.

5. Conclusion

Out of the 130 patients whose records we examined, 69 were having left-sided hemiparesis and 61 were having right-sided hemiparesis. Out of 69 patients with left-sided hemiparesis, 16 were independent (mildly and moderately dependent) and out of 61 with right-sided hemiparesis, 35 were independent (mildly and moderately dependent). Patients with right-sided hemiparesis were independent functionally. So, it can be clearly concluded that there is a strong relationship exists between functional independence of patients and their side of hemiparesis.

Conflicts of interest

All authors have none to declare.

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