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Original Research Article

Association of Severity, Voluntary Control, Cognition, Balance and Gait Parameters to the Functional Independence and Quality of Life in Stroke

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ABSTRACT

Introduction: Multiple risk factors including age, gender, dependency in Activities of Daily Living (ADL)/disability, social support, depression have been associated with poorer Health Related QOL (HRQOL) in stroke survivors. Critical review of literature reflects limited Indian studies exploring different factors on stroke recovery. It is of a much need to associate factors predicting stroke recovery so that it becomes easy for the healthcare professionals to predict the recovery.
Aim: To find out association between severity, voluntary control, cognition, balance and gait to the functional independence and QOL in stroke patients.
Methodology: It is a cross sectional exploratory study where 60 stroke patients were included of all gender, type and duration. Along with the basic demographic data subjects were also assessed for severity of stroke (National Institute of Health Stroke Scale (NIHSS)), cognition (Mini Mental State Examination (MMSE)), voluntary control (Stroke Rehabilitation Assessment of Movement (STREAM)), balance (Berg Balance Scale (BBS)), gait (10Meter Walk Test (10MWT)), functional independence measure (FIM) and QOL (Stroke Impact Scale (SIS)).
Statistics: NIHSS, STREAM, MMSE, BBS and 10MWT were correlated with FIM and SIS with non parametric spearman test keeping $p < 0.001$.
Results: Severity of stroke was negatively correlated with FIM and SIS. Voluntary control, cognition, balance and gait parameters are significantly positively correlated with FIM and SIS scores.
Conclusion: Severity of stroke, cognition, voluntary control, balance and gait are significantly associated with the functional independence and quality of life in stroke patients. One can predict the stroke recovery using these assessment scales.
Key words: Stroke, Association, Quality of life, Functional Independence.

INTRODUCTION

The World Health Organization (WHO) clinically defines stroke as the rapid development of clinical signs and symptoms of focal neurological disturbance lasting for more than 24 hours or leading to death, with no apparent cause other than vascular origin. [1] In 2015, stroke was the second most frequent cause of death after coronary artery disease accounting for 6.3 million deaths. [2] The overall prevalence of stroke is higher among Asians and in India it is about 250-300/10,000 populations per year. [3] The estimated adjusted prevalence rate of stroke ranges from 84-262/100000 in rural to 334-424/100000 in urban areas. The incidence rate is 119-145/100000 based on the recent population based studies. [4]

Quality Of Life (QOL) decreases, even among those who have no post stroke disability. [5] Multiple risk factors including age, [6,7] gender, [8] dependency in Activities

of Daily Living (ADL)/disability, [7] social support, [9] depression [7,8,10] have been associated with poorer Health Related QOL (HRQOL) in stroke survivors.

Douglas Chumney et al in 2010 have concluded in their systemic review that very limited evidence exists to predict functional outcome of stroke. [11] They recommended for well developed research to examine the use of Functional Independence Measure (FIM) in predicting functional outcomes.

Critical review of literature reflects limited Indian studies exploring different factors on stroke recovery. It is of a much need to associate factors predicting stroke recovery so that it becomes easy for the healthcare professionals to predict the recovery.

Aim:

Primary aim of present research is to find out association between different assessments parameters to the functional independence and QOL in stroke patients.

METHODOLOGY

An exploratory study was conducted on stroke patients with purposive sampling. n= 60 diagnosed cases of single episode of ischemic / hemorrhagic, sub-acute and chronic stroke of either gender were recruited. Subjects with hemiparesis secondary to trauma, subjects with unstable vitals and in acute ICU care & patients not willing to participate were excluded.

This study is a part of large study titled "factors affecting stroke outcome" which has been approved by Institutional Ethics Committee with reference no. PTC/IEC/22/2015-16. Recruitment of patients with stroke was done as per selection criteria. 72 subjects with stroke were screened from Feb 2016 to April 2018. 60 patients completed all formalities and their data was recorded. There were 6 patients who could not finish the Quality of Life questionnaire and so for quality of life, n=54 only.

Basic demographic details taken include age, gender, education, occupation, type of stroke, side of hemiplegia, duration of stroke and care giver information etc. Following Stroke related variables were measured:

1) National Institute of Health Stroke Scale (NIHSS) was used to measure the severity of stroke. This scale is highly reliable and valid clinical scale used for stroke patients. [12] It is accepted as the definitive clinical examination to assess stroke severity. [13] In this scale as the score increases, the severity decreases.

2) Stroke Rehabilitation Assessment of Movement (STREAM) scale was used to measure voluntary control. This scale was found to have good concurrent and predictive validity in acute inpatient rehabilitation population. [14] There are three subscales of it: STREAM Upper Limb (UL), STREAM Lower Limb (LL) and STREAM Basic Mobility (BM). Higher score indicates better voluntary control.

3) Functional Independence Measure (FIM) was used to measure the functional status of the patients. It is an 18 items scale divided into two subscales: motor and cognition. The inter-rater reliability ranges from 0.86 to 0.88 and the concurrent validity ICC >0.83. [15] Higher scores indicate better independence in functions.

4) Mini Mental State Examination (MMSE) scale was used to measure cognitive function in stroke patients. [16] Higher score of the scale indicates better cognition.

5) Berg Balance Scale (BBS) was used here to measure the balance of the patients. This scale was found to be psychometrically sound measure of balance impairment for use in post stroke assessment. [17] Higher score indicates better balance performance.

6) 10 Meter Walk Test (10MWT) is a performance measure used to assess walking speed in meters per second over a short distance. The test is psychometrically robust & suitable for clinical use in stroke patients. [18]

7) Stroke Impact Scale (SIS) is a self administered scale for measuring QOL in post stroke patients. Development of the SIS

was based on a study at the London Centre on Aging, University of Kansas Medical Centre. [19] SIS version 3.0 is composed of 59 items investigating 8 domains like Strength, Memory, Emotion, Communication, ADL, Mobility, Hand function, Social Participation. Each domain contains different number of items ranging 4-10. Low total score indicates high impact on QOL of stroke survivors. This scale was validated in Gujarati as a part of the large study. [20]

All the subjects suitable to selection criteria were explained about the nature & purpose of study. Written informed consents of patients or primary caregivers (in case if patient is not able to give consent) were taken prior.

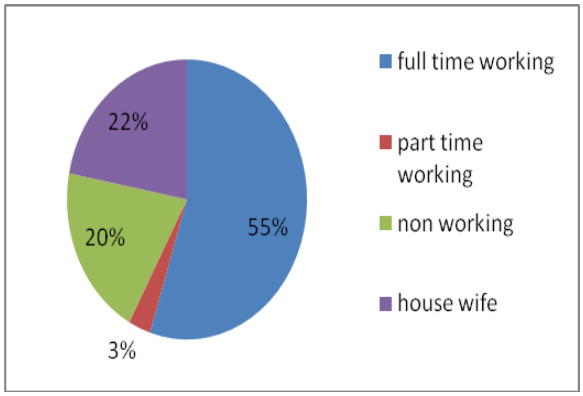
Statistical analysis:

Statistical analysis was done using SPSS 16.00 version. All the parameters were correlated while keeping significance level < 0.05. As all the data were ordinal except for SIS score, spearman correlation test was applied.

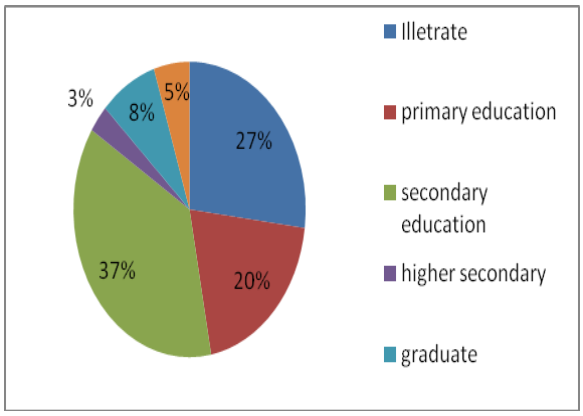
RESULTS

Table 1: Demographic details of the subjects:

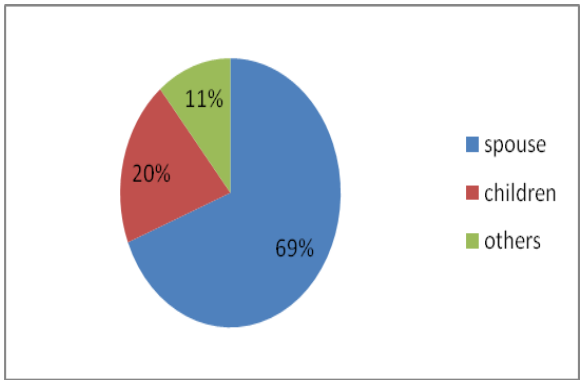
Total no	60
Mean age ±SD	54.90 ± 1.25 years
Range of Age	28-85 years
No of males/ females	42/18
Domain rt/lt	57/3
Side of stroke rt/lt	33/26
Type of stroke ischemic/ hemorrhagic	52/8
Mean Stroke duration (months)± SD	14.28 ± 2.45



Graph 1. Occupation wise distribution of subjects:



Graph 2: Education wise distribution of subjects:



Graph 3: percentage of primary care givers of the patient.

Table 2: Correlation matrix of different variables with functional independence measure.

Correlation of variables	no of sub	spearman r	p value	interpretation
NIHSS vs FIM	60	(-0.701)	0.000	Strong negative
STREAM vs FIM	60	0.709	0.000	Strong positive
STREAM UL vs FIM self care	60	0.598	0.000	Mod. Positive
STREAM LL vs BBS	60	0.535	0.000	Mod. Positive
STREAM LL vs FIM locomotion	60	0.542	0.000	Mod. Positive
STREAM LL vs FIM mobility	60	0.447	0.000	Mod.positive
MMSE vs FIM	60	0.519	0.000	Mod. Positive
MMSE vs FIM social cognition	60	0.634	0.000	Mod. Positive
BBS vs FIM	60	0.710	0.000	Strong positive
BBS vs FIM mobility	60	0.744	0.000	Strong positive
BBS vs FIM locomotion	60	0.702	0.000	Strong positive
10 MWT vs FIM	60	0.531	0.000	Mod. Positive
10MWT vs FIM mobility	60	0.543	0.000	Mod. Positive
10 MWT vs FIM locomotion	60	0.528	0.000	Mod. Positive

Table 3: Correlation matrix of different variables with quality of life.

Correlation of variables	no. of subjects	spearman r	p value	Interpretation
NIHSS vs SIS 1 (strength)	54	(-0.509)	0.000	Mod. Negative
NIHSS vs SIS 4 (communication)	54	(-0.557)	0.000	Mod. Negative
STREAM UL vs SIS 7 (hand function)	54	0.629	0.000	Moderate positive
STREAM BM vs SIS 6 (mobility)	54	0.726	0.000	Strong positive
MMSE vs SIS 2 (memory)	54	0.440	0.001	Mod. Positive
BBS vs SIS 6 (mobility)	54	0.695	0.000	Strong positive
10MWT vs SIS 6 (mobility)	54	0.357	0.008	Mod. Positive
FIM total vs SIS 5 (ADL/IADL)	54	0.729	0.000	Strong positive

DISCUSSION

The study aimed to find out association of different assessment parameters to functional independence and QOL in stroke patients. Though there are many confounding factors like personal, psychological, social, economical and lot more which can affect the recovery of the patient from stroke, it has been tried to focus on few outcome measurements which can predict the prognosis of the patients.

The collected data was of 60 subjects, out of which 6 subjects did not finish the QOL measurement scale SIS and so, for the correlation of different parameters to the QOL, only 54 subjects' data was analysed.

Correlation of different parameters to the Functional Independence Measures. (table 2)

In this study, NIHSS was used to measure the severity of stroke. In this scale as the score increases, the severity decreases. And so the scores of the scale are negatively correlated with all those outcomes where higher score predicts better outcome. Correlation of NIHSS to FIM total was strong negative (r = (-0.701)) and highly significant. This shows that as the severity of stroke increases, the functional independence decreases. Present study findings are supported by R Ahmed et al who found NIHSS to be a good predictor of functional outcome tested by Barthel Index in patients with ischemic stroke. [21]

Total score of STREAM has significantly strong positive correlation (r = 0.709) with total score of FIM. The subscales also showed positive correlation with each other. STREAM UL scores were correlated with FIM self care where as STREAM LL scores were correlated with FIM locomotion and mobility. They showed highly significant moderate positive correlation with each other. The results show that as the voluntary control improves, the functional independence status of the patient also improves. These findings are supported by findings of Ward et al 2011 while checking predictive and concurrent validity of STREAM. [14] They found strong positive correlation between STREAM and FIM (r = 0.77 and 0.78 respectively) at the time of admission and discharge in acute stroke patients.

MMSE scores were correlated with FIM total and FIM cognition scores. The correlation coefficients were 0.519 and 0.634 respectively which shows significant moderate positive correlation with the functional status. Cognitive and behavioural syndromes are frequent and often chronic consequences of stroke. Executive deficits proved to be the most robust cognitive predictor of poor functional recovery after stroke. [22]

The scores of BBS were correlated with FIM total, FIM mobility and FIM locomotion. All correlations were found to be significant and strong positive (0.710, 0.744 and 0.702 respectively). Sitting balance has been explored as prognostic factor for stroke rehabilitation at tertiary care hospital by K J Sandin et al. [23] Strong positive correlation was found between Barthel Index and sitting balance scores. [23] It was also concluded that evaluation of sitting balance can be helpful in anticipating functional status at discharge in stroke patients.

The 10 meter walk test was used to measure the gait speed. The speed was

correlated with FIM total, FIM mobility and FIM locomotion. All three correlations were found to be significantly moderate positive. It is very clear that gait speed and functional status improves hand in hand and improvement is seen in both the parameters.

Correlation of different parameters to the Quality of Life (table 3).

The severity of stroke (NIHSS scores) was correlated to SIS subscale 1 which measures overall strength and to SIS 4 which measures communication. Both correlations were found to be significantly moderate negative ((-0.509) and (-0.557)). As discussed earlier, as the severity of stroke increases, the score on NIHSS decreases. Negative correlation between the variables indicates that as the severity of stroke increases, the quality of life worsens. Maria Jose et al 2018 have found inversely proportional relationship between severity of stroke and disability and QOL on 131 ischemic stroke patients where QOL was measured using Stroke Specific QOL (SS-QOL) scale. [24]

STREAM UL was correlated to SIS subscale 7 which is of hand function whereas STREAM BM was correlated with SIS subscale 6(mobility). The correlation coefficient of STREAM UL vs SIS 7 was found to be 0.629 and of STREAM BM vs SIS 6 was 0.726. This shows that as the voluntary control improves, the quality of life also improves. Total score of STREAM was correlated positively with SIS-16 (r = 0.707) in acute stroke patients while checking predictive and concurrent validity of STREAM. [14]

Correlation coefficient of MMSE vs SIS subscale 2 (memory) was found to be 0.44. This is significantly moderately positive. This shows that as the cognition of the patient improves the quality of life also improves. In contrast to present study no significant impact of cognitive impairment was found on patient's QOL in a study by Vincent et al. [25] However this conclusion was restricted to a specific group of stroke survivors. Another study has concluded that cognitive impairments are important predictors of long term depressive symptoms and QOL after stroke. [26]

BBS was correlated with SIS subscale 6 (mobility) and the correlation was found to be significantly strong positive (r = 0.695). The correlation between 10MWT and SIS 6 was found to be 0.357 which is weak positive. Both shows that as the balance and gait speed increases, the QOL also improves. In support to this findings, BBS scores were found to be significantly correlated with SS-QOL (r = 0.394, p = 0.002). It was concluded that balance impairments and fall risk are associated with lower QOL in chronic stroke. [27] BBS is a performance based scale while SIS is a self administered score having more subjectivity. Few patients showed good performance of balance while assessment but their perception of QOL for mobility was not up to the mark causing low scores of SIS which could be the justification for weak positive correlation.

The functional independence scores were found to be strong positive correlated with SIS 5 which is of ADL/IADL. This shows that having independency in functions of daily life improves patient's Quality of Life. Presence of anxiety, depression and functional dependence (low FIM) were associated with impaired QOL in Indian stroke survivors. [28] Kyng Kim et al also found high correlation between ADL of patients with chronic stroke and their QOL. Among FIM items, mobility (transfer) and social cognition had the largest effects on total QOL. [29]

Majority of findings of the study are supported by similar articles available as a literature. The parameters assessed on a particular duration post stroke also matters in predicting the functional status and QOL. A study has concluded that parameters assessed on day 7 post stroke are more predictive than the difference between stroke onset and day 7 post stroke. [30] Inclusion of any type of stroke without specifying the post stroke duration and wider age range may limit the generalization of results.

CONCLUSION

Severity of stroke, cognition, voluntary control, balance and gait are important factors associated with the functional independence and quality of life in stroke patients.

REFERENCES

1. World Health Organization. Preventing Chronic Diseases: A vital investment. Geneva, Switzerland. 2005.
2. GBD 2015 Mortality and Causes of Death, Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: "a systematic analysis for the Global Burden of Disease Study 2015". Lancet. 2016;388(10053):1459-544.
3. Sarti C, Rastenyte D, Cepaitis Z, Tuomilehto J. "International trends in mortality form stroke 1968 to 1994" Stroke. 2000;31:1588-601.
4. Pandian JD, Sudhan P. "Stroke epidemiology and stroke care services in India" Journal of Stroke. 2013;15(3):128-34.
5. Lai MS, Studenski S, Duncan PW, Perera S. "Persisting consequences of stroke measured by the stroke impact scale" Stroke. 2002;33:1840-44.
6. Rochette A, Desrosiers J, Norrau L. "Association between personal and environmental factors and occurance of handicap situation following a stroke" Disabil Rehabil. 2001;23:559-69.
7. Sturm JW, Donnan GA, Dewey HM, Macdonell RA. "Determinants of handicap after stroke: North East Melboure Stroke Incidence study" Stroke. 2004;35:715-20.
8. Carod-Artel J, Egido JA, Gonzalez JL, de seijas EV. "Quality of life among stroke survivors evaluated one year stroke. Experience of a stroke unit" Stroke. 2000;31:2995-3000.
9. Meckenzie AE, Chang AM. "Predictors of quality of life following stroke" Disabil Rehabil. 2002;24:259-65.
10. Suenkeler IH, Nowak M, Misselwiz B, Kugler C, Schreiber W, Oertel WH, et al. "Time course of health related quality of life as determined 3,6 & 12 months after stroke: relationship to neurological deficit, disability & depression."J Neurol. 2002; 249(9):1160.
11. Chumney D, Nollinger K, Shesko K, Skop K, Spencer M, Newton RA. "Ability of functional independence measure to accurately predict functional outcome of stroke- systemic review." J Rehabil Res Dev. 2010;47(1):17-29.
12. Brott T, Adams HP Jr, Olinger C P, Marler J R, Barsan W G, Biller J et al, "Measurement of acute cerebral infarction: A clinical examination scale." Stroke 1989 July;20(7) 865-70.
13. Richardson J, Murray D, House K C, Lowenkopf T. "Successful implementation of the National Institutes of Health Stroke Scale on a stroke/neurovascular unit." J neurosci nurs 2006 sep;38 (suppl):309-15.
14. Ward I, Pivko, S., Brooks G, Parkin K. "Validity of stroke rehabilitation assessment of movement scale in acute rehabilitation: a comparison with functional independence measure and stroke impact scale." Physical Medicine and Rehabilitation.2011 Nov; 3(11): 1013-21.
15. Linacre JM, Heinemann AW, Wright BD, Granger CV, Hamilton BB . "The structure and stability of the functional independence measure." Arch Phys Med Rehabil. 1994.75: 127-132.
16. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State: A practical method for grading the cognitive state of the patients for the clinician." Psychiatr Res. 1975;12: 189-198.
17. Blum L., Korner-Bitensky N. "Usefulness of the Berg Balance Scale in stroke rehabilitation: A systematic review." Physical Therapy 2008;88(5): 559-566.
18. Sarah Tyson, Loise Connell. "The psychometric properties and clinical utility of measures of walking and mobility in neurological condition: a systematic review." Clinical rehabilitation 2009;23: 1018-1033.
19. Duncan PW, Wallace D, Studenski S, Lai SM, Johnson D. "Conceptualization of a new stroke-specific outcome measure: The Stroke Impact Scale." Topics in Stroke Rehabilitation. 2001;8(2):19-33.
20. Diwan S.J.,Shah Z.R., Joshi P.B., "Validation of Gujarati translated version of stroke impact scale." Journal of clinical and diagnostic research. 2018 Aug;12(8),YC13-YC16.
21. Ahmed R, Zuberi BF, Afsar S. "Stroke scale score and early prediction of outcome after

stroke." J Coll Physicians surg Pak. 2004 May; 14(5):267-9.
22. Lesniak M, Bak T, Czepiel W, Seniow J, Czlonkowka A. "Frequency and prognostic value of cognitive disorders in stroke patients." Dementia and Geriatric cognitive disorders. 2008;26(4), 356-363.
23. K J Sandin, Smith BS. "The measure of balance in sitting in stroke rehabilitation prognosis." Stroke. 1990; 21;82-86.
24. Melo M J, Ismenia D C, Tamires LD, Pedro B N. "Quality of Life after stroke: impact of clinical and sociodemographic factors." Clinics (Sao Paulo) 2018; 73: e418.
25. Vincent IH, Martien Limburg, Rob dehaan. "Role of cognitive impairment in QOL after ischemic stroke." Journal of Neurology 23(8), 599-604, 1996.
26. Nys GM, van Zandvoort MJ, van der Wrop HB, de Haan EH, de Kort PL Jansen BP et al. "Early cognitive impairment predicts long term depressive symptoms and QOL after stroke." Journal of the neurological sciences, 2006;27(2):149-156.
27. Schmid AA, Van P. M., Miller KK, Altenburger PA, Combs SA, Page SJ. "Balance is associated with quality of life in chronic stroke." Top stroke Rehabil. 2013 Jul-aug;20(4):340-6.
28. Raju R. S., Sarma P. S., Pandian J. D., "Psychosocial problems, QOL and functional independence among Indian stroke survivors." Stroke 2010;41:2932-2937.
29. Kyng Kim, Young Mi Kim, Eun Kyung Kim, "Correlation between the activities of daily living of stroke patients in a community setting and their Quality of life." J Phys Ther Sci. 2014 Mar;26(3):417-419.
30. Woldag H, Gerhold LL, de Groot M, Wohlfart K, Wagner A, Hummelsheim H . "Early prediction of functional outcome after stroke." Brain Inj 2006 Sep;20(10): 1047-52.

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