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Sensori-motor recovery in post-stroke shoulder pain: a correlation study

Ushnish Mukherjee¹, Sourav Kundu²*, Rachit Gulati³, Pankaj Kumar Mandal¹

¹Department of Physical Medicine & Rehabilitation, MR Bangur, Kolkata, West Bengal, India

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*Correspondence:

Dr. Sourav Kundu,

E-mail: dr.sourav.kundu.84@gmail.com

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ABSTRACT

Background: The prevalence of pain in affected shoulder among post-stroke patients ranges from 34% to 84%. Numerous theories exist to explain the patho-mechanics behind development of Post-stroke shoulder pain, but its relationship with the sensori-motor recovery of the affected limb is still controversial. This study was conducted to detect the correlation, if any, between post-stroke shoulder pain and sensori-motor recovery of the affected upper limb

Methods: This observational longitudinal study was conducted on 73 patients of both sexes within the age group of 45-65 years having presentation of post-stroke (duration<6weeks) shoulder pain. Pain intensity was recorded in numerical rating scale (NRS). Sensorimotor recovery of the affected limb was assessed by Fugl- Meyer assessment scale of upper extremity (FMA-UE). Data were collected at the baseline (visit1), at 6 weeks (visit 2), 12 weeks (visit 3) and at the end of the study i.e., 24 weeks (visit 4).

Results: Statistically significant negative correlations were found between severity of pain (assessed with NRS) and sensory-motor recovery (assessed with FMA-UE) on each visit with correlation coefficients (Spearman rho, r) being r=-0.890, p=0.000 on visit1, r=-0.685, p=0.000 on visit2, r=-0.629, p=0.000 on visit3 and r=-0.458, p=0.000 on visit4.

Conclusions: Post-stroke shoulder pain plays a significant negative role in sensori-motor recovery of the affected upper limb requiring early intervention.

Keywords: Post-stroke shoulder pain, Fugl-Meyer assessment scale of upper extremity, Numerical rating scale

INTRODUCTION

Stroke is the one of the most common neurological condition leading long-term disabilities in many ways. 1,2 The prevalence of pain in the affected shoulder amongst post-stroke patients ranges from 34% to 84%. 1,3,4 According to the recent studies, it affects between 50% and 80% of all stroke survivors and the mean overall prevalence of pain is 29.56%. 5,6 The pathogenesis of post-stroke shoulder pain (PSSP) remains controversial probably due to its multifactorial origin. A number of aetiological factors have been postulated in this regard.

Reported Causes of PSSP are namely adhesive capsulitis (most common), subluxation, impingement syndrome, rotator cuff injury, bicipital tendonitis, complex regional pain syndrome type 1, brachial plexopathy, axillary neuropathy, suprascapular neuropathy, myofascial pain, spasticity, soft tissue contracture.^{2,3}

Over the decades several studies were conducted to find out the role of these aetiological factors in generating post-stroke shoulder pain. But in the last decade focus was shifted more towards assessing the functional recovery in these patients with PSSP. More and more studies were conducted to find out its relation to the

²Public Health Specialist in the rank of ACMOH, State Dengue Cell, Swasthya Bhawan, West Bengal, India

³Department of Physical Medicine & Rehabilitation, AIIMS, Bhopal, Madhya Pradesh, India

sensory-motor recovery of the affected upper limb. But they have shown varying degree of co-relation with the intensity of shoulder pain.⁵⁻¹⁰

So, till date, controversy still exists regarding the direct correlation between the sensori-motor recovery and the intensity of PSSP. Therefore, this correlation study was done by assessing the sensorimotor recovery of the affected limb with Fugl-Meyer assessment-upper extremity (FMA-UE) score as well as the intensity of shoulder pain by numerical rating scale (NRS). 10-12

Aim

Aim was to detect the correlation, if any, between Poststroke shoulder pain with sensori-motor recovery of the affected upper limb.

METHODS

This observational longitudinal study was initiated after receiving the approval from the Institutional Ethics Committee. All the stroke patients receiving standardized medical and rehabilitation measures from June 2015 to August 2016 at the Department of Physical Medicine & Rehabilitation, R.G. Kar Medical College & Hospital, Kolkata, West Bengal, were screened according to the following inclusion and exclusion criteria and data were collected at the baseline (visit1), at 6 weeks (visit 2),12 weeks (visit 3) and at the end of the study i.e., 24 weeks (visit 4) after receiving proper informed consent. Study design flow-chart shows in (Figure 1).

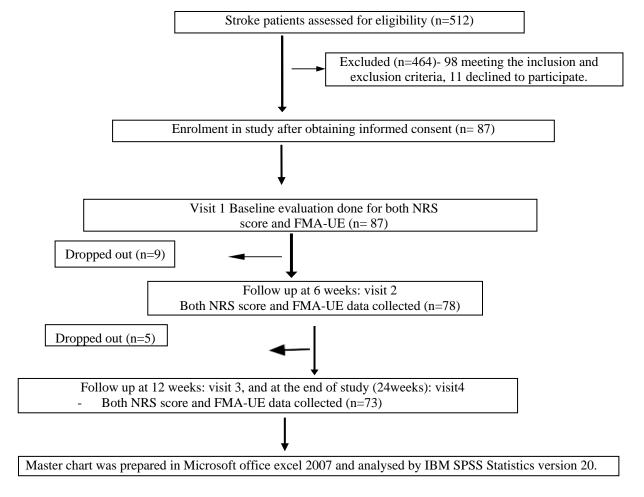


Figure 1: Study design flow-chart.

Inclusion criteria

Inclusion criteria were 1) first time stroke patients with post stroke painful hemiparetic shoulder 2) stable neurologic status 3) sufficient communicative ability 4) age between 45 years to 65 years 5) duration of stroke<6weeks.¹⁻³

Exclusion criteria

Exclusion criteria were 1) prior shoulder disorder, surgery, bony pathology impairing the movement of shoulder joints 2) bilateral shoulder involvement 3) upper limb spasticity score>3 in modified sshworth scale 4) presence of central pain, complex regional pain syndrome, contractures 5) hemineglect in affected upper

limb 6) presence of cerebellar involvement 7) patients with diagnosed Brachial plexus injury 8) clinical screening of affected shoulder showing palpable gap between the acromion and the humeral head, i.e., shoulder subluxation.²

Procedures for measuring parameters

The intensity of shoulder pain was measured by the subjective response of the patients in 11-point NRS for pain (0-10, where 0 denotes no pain and 10 denotes worst possible pain).¹²

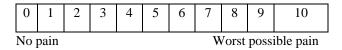


Figure 2: Procedures for measuring parameters.

Sensori-Motor recovery assessment of whole kinetic chain of the affected upper limb was done by FMA-UE with the following testing protocol 1) clear instructions for the required movements 2) first the patient had to perform the required movements on the non-paretic side. Testing of the paretic side was done when the patient fully understood the required movement. The test was repeated three times and the highest score was written down 3) testing the upper extremity is done while the patient is in the upright (seated) position. The maximum possible total score of FMA-UE is 126.¹¹

RESULTS

The total number of participants in this study was initially 87. Among them 14 participants were excluded from the analysis as they did not appear for timely follow-ups. So, the analysis was done for total 73 participants. Master chart was prepared in Microsoft office excel 2007 and analyzed by IBM SPSS Statistics version 20.

Demographical characteristics- The minimum and maximum age among all the patients were 50 years and 67 years respectively with mean (SD) $58.02~(\pm4.27)$ years. Gender distribution showed a male predominance with total 51 (69.86%) male and 22 (30.14%) female. Body mass index (BMI) of the participants ranged from $17.08~kg/m^2$ to $30.22~kg/m^2$ with the mean (SD) $22.61~(\pm3.12)~kg/m^2$.

Type of stroke was mainly ischemic affecting total 48 (65.75%) patients, middle cerebral artery territory with most common involvement of lenticulostriate branch. Time gap between the onset of stroke and initiation of this study was 21.14±6.05 (days) among all the patients with a range of 18-37 days.

Distribution of NRS and FMA-UE scores on all the visits were tested for normality with Shapiro-wilk test and it was found that NRS scores on no visit was normally distributed and only values on 2nd & 3rd visit FMA-UE

scores had normal distribution. Henceforth while assessing correlation between NRS & FMA-UE on different visits Sprearman's rho (r) was considered as part of non-parametric analysis.

On analysis it was found that NRS had statistically significant strong negative correlation (r=-0.890) with FAM-UE on first visit. On 2nd and 3rd visit the correlation remained statistically significant and negative though of moderate strength (r=-0.685 & -0.629 respectively). 4th visit presented with lower negative correlation strength (r=-0.458, p-value 0.000) between NRS and FMA-UE.

Table 1: Distribution of NRS and FMA-UE on different visits with correlation in between.

S. no.	Visit	NRS median (IQR)	FMA- UE median (IQR)	Correlation coefficient Spearman's rho (r)	P value
1	Visit 1	6 (2)	33 (5)	-0.890	0.000
2	Visit 2	6 (1)	53 (5)	-0.685	0.000
3.	Visit 3	4 (2)	66 (7)	-0.629	0.000
4.	Visit 4	2 (2)	88 (8)	-0.458	0.000

IQR= inter quartile range

DISCUSSION

In our study, at the base level, i.e., on visit 1 the maximum NRS value among the stroke patients was 8 and the minimum was 5, with the median (IQR)= 6 (2). Baseline FMA-UE score ranges from only 28 to 42 out of total possible score of 126, with median (IQR)= 33 (5). Subsequent visits showed steady increase in FMA-UE score [Median (IQR) at V2: 53 (5) & V3: 66 (7)] suggesting improvement in limb function with simultaneous decrease in shoulder pain [NRS score median (IQR) at V2: 6 (1) & V3: 4 (2)]. At the end of the study (visit 4), FMA-UE score was maximum of all visits [median (IQR)= 88 (8)] and NRS score [median (IQR)=2 (2)] was minimum. While assessing the correlation between FMA-UE and NRS score by sprearman's rho (r), we found statistically significant (p=0.000) negative correlation between them in all visits. But the strength of correlation was strongest at visit1 (r=-0.890) and it gradually decreased in subsequent visits (V2: r=-0.685, V3: r=-0.629), ultimately being weakest on the final visit (r=-0.458). This type of correlation suggests that sensorimotor recovery of the hemiparetic upper limb is hampered by the presence of shoulder pain and more so in early days of stroke.

Previous studies also showed that stroke survivors with shoulder pain have more severe motor impairment during recovery with more activity limitations.^{5,8} But these

findings have not been confirmed by a few other studies. 7,9,10

Among the recent publications, Holmes et al concluded that reduced motor function in upper limb is significantly related with post stroke shoulder pain, which is also clearly evident from our study. ¹³ Lindgren et al concluded that PSSP is an important predictor of affected upper limb recovery and requires multidisciplinary approach to manage PSSP for faster limb recovery- which is also the clinical implication of our study. ¹⁴

Limitations

Sample size was small. Outcome difference between dominant and non-dominant hemisphere involvement, ischemic and hemorrhagic stroke was not compared. All these limitations are future perspective of our study where different interventional methods for managing post stroke shoulder pain can be compared on large scale in different stroke patterns.

CONCLUSION

The severity of post stroke shoulder pain is strongly associated and can hamper the sensory-motor recovery of the affected upper limb. So, post stoke rehabilitation programs should have special focus on managing post stroke shoulder pain for faster recovery of affected upper limb.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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