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ORIGINAL ARTICLE

PREVALENCE OF PUSHER'S SYNDROME AMONG STROKE PATIENTS IN JALGAON CITY BY USING FOUR-POINT PUSHER SCORE: AN OBSERVATIONAL STUDY

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ABSTRACT:

Background: Following damage to the left or right side of the brain, a clinical condition known as "Pusher syndrome" may develop. Individuals who suffer from unilateral strokes may deliberately push toward their paretic side with their non-paretic limbs, which can lead to postural instability.

Methodology: This observational study included 77 stroke patients selected through predefined criteria, with informed consent obtained. PS was assessed using the Four-Point Pusher Score (4PPS). Data were analysed using MS Excel and Minitab 17, and summarised using descriptive statistics (mean and standard deviation).

Result: The Four-Point Pusher Score (4PPS) revealed that 12.99% of participants showed no pushing, 25.97% had mild pushing, and 48.05% demonstrated moderate pushing, which was the most common level. Severe pushing was observed in 12.99% of participants.

Conclusion: This study concluded that PB is notably prevalent among stroke patients, with moderate PS being the most common presentation (48.05%), followed by mild pushing (25.97%).

Keywords: Contraversive pushing, Prevalence, Stroke patient

INTRODUCTION:

Stroke is a clinically defined syndrome of acute, focal neurological deficit attributed to vascular injury (infarction, hemorrhage) of the central nervous system. Stroke is the second leading cause of death and disability worldwide.[1] Ischemic and primary hemorrhagic strokes are two subtypes of strokes that can be further categorized. Ischemic stroke is a condition characterized by neurological dysfunction resulting from a focal cerebral, spinal, or retinal infarction with symptoms lasting for more than 24 hours.[2] About 80% of stroke victims experience ischemic stroke, which occurs when a clot blocks or reduces blood flow, depriving the brain of essential nutrients and oxygen.[3]

On the other hand, a transient ischemic attack (TIA) is described as a brief period of neurological impairment caused by a localised lack of blood flow to the brain, spinal cord, or retina without a simultaneous acute infarction. The symptoms are temporary, typically lasting from a few minutes to a few hours, but no longer than 24 hours. TIAs are often labelled as mini-strokes.[2] Hemorrhagic stroke is a condition in which blood leaks into or around the brain due to a ruptured blood vessel.[3] It is divided into two categories: subarachnoid haemorrhage (SAH), which accounts for around 5% of all strokes, and intracerebral hemorrhage (ICH), which accounts for approximately 10% of all strokes.[2]

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The Stroke Roundtable Consortium has categorised the time following a stroke into phases. The acute phase spans the first 7 days, the early sub-acute phase extends for the first 3 months, the late sub-acute phase covers months 4 to 6, and the chronic phase begins after 6 months.[4]

There are many physical impairments after a Stroke, one of them is PUSHER's SYNDROME.

After a stroke, many individuals experience balance and postural control issues due to the need for intact motor and sensory processes to maintain equilibrium. Approximately 53% of patients have sensory abnormalities, and 88% experience hemiparesis. As a result of these impairments, elements of balance such as steadiness, symmetry, and dynamic stability are affected, contributing to overall disability.[5]

Following damage to the left or right side of the brain, a clinical condition known as "Pusher syndrome" may develop. It is also known as ipsilateral pushing, contraversive pushing, pushing behaviour or lateropulsion.[6,9] Individuals who suffer from unilateral strokes may deliberately push toward their paretic side with their non-paretic limbs, which can lead to postural instability.[7]

Research on individuals exhibiting extreme contraversive pushing has revealed that they perceive their bodies as being "upright" when they are inclined (up to 18 degrees) to the side of the brain lesion, known as the ipsilesional side. This indicates a changed perception of body posture in relation to gravity.[6]

Patricia Davies first documented the unexpected behaviour of certain stroke patients in 1985. These patients tend to push toward the paretic side using their non-paretic extremities.[6]

The patient displays no fear, even when active pushing causes instability and strongly resists any attempts to passively correct posture to midline. This pattern contradicts the expected postural deficiency, which is increased weight-bearing on the stronger side to offset deficits on the hemiparetic side, observed in most stroke patients.[3]

The term lateropulsion is interchangeable with pusher's syndrome. Lateropulsion can affect the ability to sit and stand, and in more severe cases, it can also impair rolling, transferring between positions, and walking.[7] Lateropulsion can also affect body orientation while lying down; patients may exhibit resistance when attempting to roll toward their unaffected side.[9]

The pathogenesis of PS is intricate, involving multiple perspectives, including subjective postural vertical[10], subjective visual vertical[10], and the second graviceptive system.[12,13]

Numerous studies indicate that PS is linked to impairments in higher-level spatial processing. This connection may clarify why patients with lesions in the right hemisphere exhibit more pronounced tilts toward the opposite side.[13]

The term "contraversive pushing", where individuals deliberately push with nonparetic extremities to the contralateral side of the brain injury (i.e paretic side), distinguishes the clinical presentation of pusher syndrome from the loss of equilibrium that may occur in other hemiparetic individuals. People who don't have pusher syndrome may experience balance problems and tend to lean towards their weaker side because of their paresis.[6]

They are conscious of losing their balance but can't support themselves properly due to their paresis, unlike those with controversies pushing. They usually grab onto objects with their non-paretic hand instead of pushing them. The phrase "pusher syndrome" should not be used to describe the various postural instability symptoms that individuals experience following brain trauma.[6]

Patients with pusher syndrome often have lesions in the posterolateral thalamus, leading to the belief that this region is primarily responsible for our ability to maintain an upright position. Patients with fronto-parietal lesions may display psychological symptoms such as neglect, motor akinesia, attentional issues, diminished awareness of deficit, defective response inhibition, clumsiness of the sound side, and frontal apraxia, in addition to pushing behavior.[14] The internal capsule, supplementary motor area, upper parietal lobe, globus pallidus, and parietal-insular vestibular cortex are additional potential and previously identified areas.[15] Post-stroke patients with pusher syndrome take longer than average to regain independence.[16]

There are currently four distinct clinical outcome measures available to screen and assess the degree of impairment associated with pushing behavior over time. These measures are: the Burke Lateropulsion Scale (BLS), the modified Scale for Contraversive Pushing (M-SCP), the Scale for Contraversive Pushing (SCP), and the Four-Point Pusher Score.[17] Among these, SCP and BLS are commonly used. Both assessment scales have their drawbacks. The BLS, while comprehensive, may be time-consuming, potentially discouraging busy clinicians from using it. On the other hand, the SCP is quicker to administer but may not identify mild pushing behavior due to the absence of a walking assessment. Furthermore, both scales lack consistency in defining the presence of pushing behavior based on cutoff scores.[18]

The Four-Point Pusher Score (4PPS) was developed by five experienced neurological physiotherapists. Its creation was grounded in clinical experience, with the characterisation of pusher syndrome described by Davies, Bohannon, and Carr and Shepherd, based on the premise that pushing behaviour (PB) is considered more severe when demonstrated in more supported postures.[18,19] For example, sitting is a more supported position than standing because it requires less muscle effort to counteract gravity. Therefore, if pushing behavior (PB) is observed while sitting, it would be considered more severe than if it were only observed while standing. Additionally, it is assumed that if PB occurs in a sitting position, it would also be present in a standing position.[20]The 4PPS has a clear advantage over other existing scales in that it reduces the time needed to identify and evaluate pushing behavior, as testing is not required in all positions. As a result, the 4PPS can efficiently be used in screening assessments for post-stroke patients.

Administering the 4PPS takes approximately 2 minutes, is easy to score, and can differentiate between mild, moderate, and severe cases of pushing behaviour. Therefore, we are using the four-point pusher score(4PPS) as an outcome measure to assess pusher syndrome in post-stroke patients.[18]

An observational study was conducted to assess stroke patients in tertiary care hospitals in Jalgaon city. The study population consisted of individuals diagnosed with stroke. A convenient (purposive) sampling technique was used to recruit participants for the study. A total sample size of 77 stroke patients was included. The study was carried out over a duration of six months at tertiary care hospitals in Jalgaon city.

A total of 77 stroke patients who met the eligibility criteria were enrolled in the study. Participants were included if they were willing to participate, were hemodynamically stable, and had a confirmed diagnosis of stroke. Patients with lesions located in the posterolateral thalamus, internal capsule, supplementary motor area, upper parietal lobe, globus pallidus, or parietal-insular vestibular cortex were also considered eligible. Additionally, participants were required to have Mini-Mental State Examination (MMSE) scores between 24 and 30, indicating the absence of cognitive impairment.

Patients were excluded from the study if they had orthostatic hypotension, agitation, excessive somnolence, or any previous orthopedic conditions that could interfere with the assessment of posture and balance. Individuals with dementia, psychiatric disorders, other neurological disorders such as multiple sclerosis or Parkinson's disease, and those with vestibular dysfunction were also excluded from the study.

Procedure:

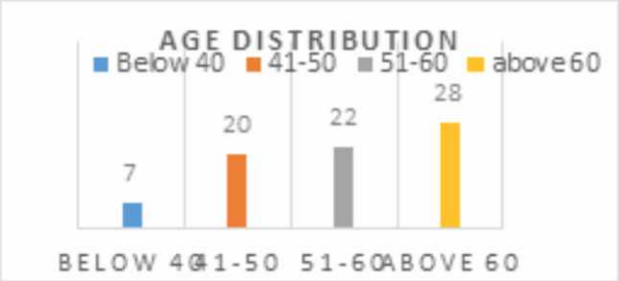
Prior to the commencement of the study, ethical clearance was obtained from the Institutional Ethical Committee, and the study was conducted in tertiary care hospitals in Jalgaon city. Participants were screened according to the inclusion and exclusion criteria, and informed written consent was obtained. Assessment was carried out using the Four-Point Pusher Score (4PPS). Based on the 4PPS, patients were scored, and the collected data were statistically analysed.

Statistical Analysis: A total of 77 stroke patients were included in the study. Data from the outcome measures were recorded in MS Excel and analysed using MS Excel and Minitab 17. Mean and standard deviation were used to summarise participant characteristics. The association between demographic variables and pushing behaviour (4PPS) was assessed using the Chi-square test of independence. Results are presented in both tabular and graphical formats for clearer interpretation.

Table 1. Age-wise distribution

Sr. No.	Variable	Groups	No. of patients	Percentage
1	Age (in years)	Below 40	7	9.09%
		41-50	20	25.97%
		51-60	22	28.57%
		above 60	28	36.36%

Age	Mean	SD
	56.53	13.94



Fugure 1. Age-wise Distribution

Table 2. Gender- wise distribution

Sr. No.	Variable	Groups	No. of patients	Percentage
2	Gender	Male	51	66.23%
		Female	26	33.77%

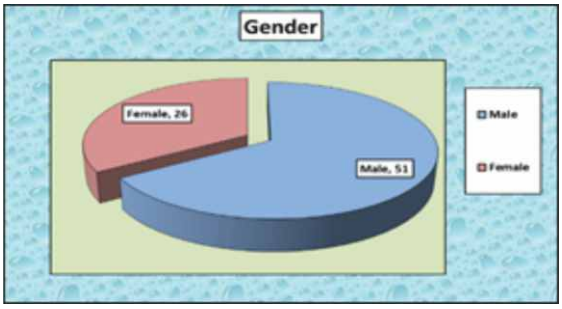


Figure 2. Gender-wise Distribution

Table 3. Percentage of Type of Stroke

Sr. No.	Variable	Groups	No. of patients	Percentage
3	Type of stroke	Ischemic	58	75.32%
		Haemorrhagic	19	24.68%

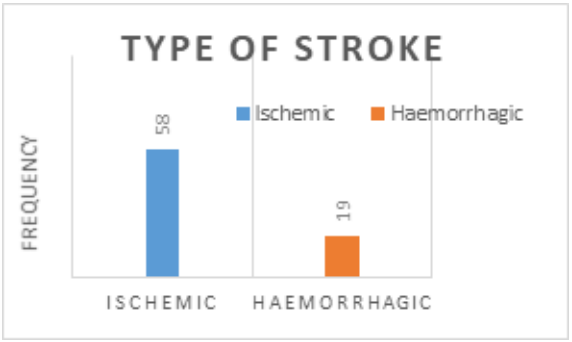


Figure 3. Percentage of type of stroke

Table 4. Percentage of Side of brain affected

Sr. No.	Variable	Groups	No. of patients	Percentage
5	Side of the Brain affected	Right brain	31	40.26%
		Left brain	46	59.74%

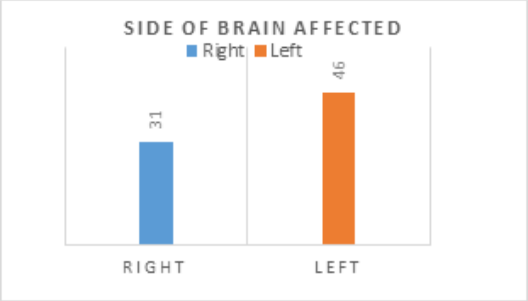


Figure 4. Percentage of side of brain affected

Table 5. Duration of Stroke

Duration of stroke (in days)	Mean	SD
	132.5	240.2

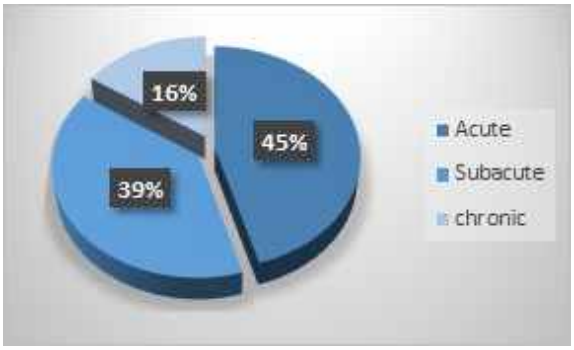


Figure 5. Stage-wise distribution

Table 6. Percentage of 4PPS Score

Sr. No.	Variable	Groups	No. of patients	Percentage
7	4 PPS Score	No Pushing	10	12.99%
		Mild Pushing	20	25.97%
		Moderate Pushing	37	48.05%
		Severe Pushing	10	12.99%

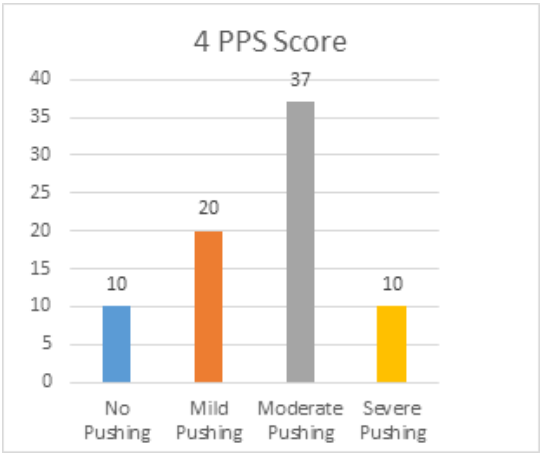


Figure 6. Percentage of 4PPS Score

Table 7. Association of Demographic variables with 4 PPS score

Variable	Groups	4 PPS score		Chi-square	d.f.	p value	Significance
		below Md	above Md				
Age	Below 40	7	0	1.77	3	0.62	Not Significant
	41-50	17	3				
	51-60	18	4				
	above 60	28	3				
Gender	Male	46	5	1.35	1	0.24	Not Significant
	Female	21	5				
Type of stroke	Ischemic	50	8	0.135	1	0.71	Not Significant
	Haemorrhagic	17	2				
Side affected	Right	27	4	0	1	0.99	Not Significant
	Left	40	6				

RESULTS: The results demonstrate that 12.99% of participants exhibited no pushing, whereas 25.97% were classified as having mild pushing. Nearly half of the sample, 48.05% fell within the moderate pushing category, representing the most prevalent level. A further 12.99% of participants were identified as having severe pushing. Overall, the data indicate that moderate pushing was the most common presentation among the study population. Chi-square analysis revealed no statistically significant association between demographic variables (age, gender, type of stroke, and side affected) and Four-Point Pusher Score (4PPS), indicating that these factors did not influence pushing behavior in the study population.

DISCUSSION: This study assessed the prevalence of pusher syndrome among 77 stroke patients. Most participants (48.05%) demonstrated moderate pushing behavior, followed by mild pushing (25.97%). Only 12.99% showed no pushing, while another 12.99% exhibited severe pushing. These findings highlight the predominance of moderate pushing among stroke patients.

This prevalence is considerably higher than that reported by Huayong Wu et al. (2025) reported an overall incidence of 5–20% in stroke [23]. by Similarly, Abe et al. reported a pusher syndrome prevalence of 9.4% among 1660 acute stroke patients[7]. The higher prevalence in this study likely reflects methodological differences. The 4PPS detects four levels of pushing, allowing identification of mild cases that may be missed by binary classifications or the standard SCP. Pedersen et al. in the Copenhagen Stroke Study, where ipsilateral pushing was found in only 10% of included patients.[24] Thus, the 25.97% of participants with mild pushing in this study might have been classified as "no pushing" in studies using less sensitive tools. Prevalence estimates can also vary based on the sample. This study included patients across all recovery stages (mean duration 132.5 ± 240.2 days), whereas many earlier studies focused only on acute stroke cases with stricter criteria. Including both acute and chronic patients may have contributed to the higher prevalence observed in this study.

In this study, moderate pushing was the most common finding, occurring in 48.05% of cases. This is likely because most strokes cause partial damage to postural control networks. Key brain areas involved in body orientation, such as the posterolateral thalamus and parietal-insular cortex, are rarely completely damaged or intact[12]. Following a stroke, the brain attempts to compensate by activating alternative pathways. Moderate pushing reflects partial compensation, where postural misperception persists despite some recovery. Because this study included patients at different recovery stages, many had progressed from severe to moderate levels. Overall, moderate pushing is most common as it represents typical stroke severity with ongoing but incomplete recovery.

In this study, left hemisphere involvement (59.74%) was more common than right (40.26%). Although previous research, including Abe et al. and Wu et al. (2025), reports a higher incidence of pusher behavior in right-sided lesions, this discrepancy may reflect differences in sampling[7,24]. Unlike studies focused specifically on patients with pusher syndrome or acute stroke, the present study assessed prevalence across all stroke cases. Similarly the Copenhagen Stroke Study found no significant link between lesion side and pushing behavior, partially supporting the current findings.

Chi-square analysis showed no significant association between demographic factors (age, gender, type of stroke, or lesion side) and 4PPS scores, indicating that pushing behavior is not influenced by basic patient characteristics[25]. Previous research suggests that pushing is more closely related to perceptual and multisensory disturbances rather than demographics. The broad inclusion of patients across all recovery stages in this study may also have reduced detectable patterns. Overall, pusher syndrome showed wide variability in severity, with moderate pushing being the most common presentation.

CONCLUSION:

This study concluded that pusher syndrome is prevalent among stroke patients, with moderate pushing behaviour being the most common presentation (48.05%), followed by mild pushing (25.97%).

LIMITATIONS:

- The study was a one-time cross-sectional assessment.
- Including patients from all stroke stages may have introduced variability affecting the observed prevalence and severity of pushing behaviour

Clinical Implications: The study revealed the importance of early diagnosis of pushing behaviour, as timely identification helps clinicians initiate appropriate management strategies, develop targeted rehabilitation plans, and ultimately support better functional recovery for patients. Integrating Magnetic Resonance Imaging (functional MRI) data into clinical decision-making processes may further facilitate the development of targeted rehabilitation strategies, ultimately advancing recovery and functional outcomes in stroke patients diagnosed with pusher syndrome.

Future Scope: Further study should include larger sample sizes and patient follow-up, as early diagnosis of pushing behaviour can help guide appropriate and timely rehabilitation.

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Conflict of Interest: There is no conflict of interest.

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