Prevalence and Impact of Central Post-Stroke Pain on Quality of Life Among Stroke Survivors: A Cross-Sectional Study

Sekplin A.S. Sekeon[1*], Asri Adisasmita[2], Mondastri K. Sudaryo[2], Aida R. Tantri[3]

[1]Graduate Student of Epidemiology, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia.
[2]Department of Epidemiology, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia.
[3]Department of Anesthesiology and Intensive Care, Faculty of Medicine Universitas Indonesia, Jakarta, Indonesia.

Corresponding Author:
Sekplin A. S. Sekeon, MD. Graduate Program of Epidemiology, Faculty of Public Health, Universitas Indonesia. Jl. Lingkar Kampus Raya Universitas Indonesia, Kota Depok 16424, Indonesia. Email: sekplin@unsrat.ac.id.

ABSTRACT

Background: *Stroke continues to be a significant public health challenge. Central post-stroke pain (CPSP) is a notable aspect of post-stroke pain that not only causes physical discomfort but also affects psychological well-being, leading to a reduced quality of life. The objective of this was to assess the prevalence of CPSP and its relationship with quality of life.* ***Methods:*** *This hospital-based cross-sectional study was conducted between August and December 2023 in Manado, Indonesia, the study involved the consecutive recruitment of stroke patients. CPSP diagnosis adhered to the 2017 criteria set forth by the American Pain Society, while quality of life was evaluated using the Indonesian version of the Stroke Specific Quality of Life (SS-QoL) scale.* ***Results:*** *The study comprised 166 stroke patients, revealing that 30.1% experienced CPSP. Notably, there was a significant difference in mean SS-QoL scores based on both the severity of the stroke and the presence of depression. Within the CPSP group, a significant variation in SS-QoL summary scores was observed between male and female patients. Those with CPSP reported significantly lower mean scores in the Thinking and Energy categories. However, there was no significant difference in the overall SS-QoL scores between CPSP and non-CPSP patients.* ***Conclusion:*** *In summary, stroke patients suffering from depression, greater severity of stroke, and those experiencing burning or pressure-like sensations are at an increased risk of having a lower quality of life.*

Keywords: *Central post-stroke pain, Quality of life, Depression, Stroke severity,Cross-sectional study.*

INTRODUCTION

Stroke is still the second leading cause of death globally and ranks third leading cause of death and disability. The burden of stroke has grown substantially, characterized by an increase in stroke incidence, stroke-related deaths, and disability-adjusted life-years lost (DALY). Most of the global stroke burden disproportionately occurs in low- and lower-middle-income countries.[1] The prevalence of stroke is also predicted to grow, especially in developing countries,[2] including Indonesia where the prevalence has increased from 7.0 per mile in 2013 to 10.9 per mile in 2018.[3] The country records the highest incidence of stroke in the Southeast Asia Region.[4]

Considering those figures, there is an urgent need for innovative approaches to long-term care for stroke survivors. Management in this chronic phase would ensure continuous and comprehensive service for post-stroke patients. Identification of residual disorders and discomfort needs to be considered. This approach requires addressing a broad spectrum

of issues including managing vascular warning signs, reassessing the causes of stroke, controlling risk factors, providing support and guidance to patients and caregivers, and identifying and treating post-stroke complications.[5]

Post-stroke pain (PSP) is one of the troubling complications and is frequently found among stroke survivors (40-72%).[6–8] Central post-stroke pain (CPSP) is one of the key features of PSP.[9] Reports from various studies revealed the prevalence of CPSP to be in the range of 8-55%.[10,11] This syndrome is characterized by pain and sensory abnormalities in the part of the body corresponding to the region of the brain with cerebrovascular injury.[10] CPSP not only causes physical discomfort but also has psychological implications. Patients with CPSP have a high suicidal tendency due to the excruciating nature of pain. Suicide attempts in patients with central pain occur in phases where pharmacological therapy does not produce optimal results. CPSP can also cause a decrease in activities of daily living, disrupt communication patterns, and reduce social activities, work, and rest, ultimately affecting various aspects of the patient's life. Therefore, CPSP needs to be recognized and handled properly to avoid these losses.[12–14]

The ever-increasing prevalence of stroke opens a need to identify and address factors that affect the QoL of stroke survivors. More research is needed to elucidate the various factors that affect QoL after a stroke. In Indonesia, to date, there have been no studies that systematically examine the complex relationship between CPSP and QoL, especially with specific tools to measure QoL among stroke patients. Although many studies have evaluated the negative impact of CPSP on QoL, this study aims to dig deeper into the specific dimensions of QoL that can be affected by CPSP. This includes exploring factors such as sensory abnormalities and comorbidities, which can have different effects on QoL degrees in CPSP patients in Indonesia. The purpose of this study was to evaluate the prevalence of CPSP and its impact on the quality of life of stroke patients.

METHODS

This study was a cross-sectional study conducted at Prof. Dr. R. D. Kandou General Hospital and two teaching network hospitals (Bethesda General Hospital and Teling Army Hospital) in North Sulawesi province, Indonesia. Stroke patients who visited the neurology clinic between August and December 2023 were enrolled in the study. We recruited the sample with consecutive sampling techniques. The sample size of 166 patients was determined by using a single proportion for a finite population with a 95% confidence interval and marginal error (d) of 5%. Samples were taken based on inclusion criteria such as having a diagnosis of stroke, age of 18 years old and above, first-time stroke, no communication barrier, and having fulfilled the questionnaires and willingness to participate. The exclusion criteria in this study were a history of cancer, brain trauma, brain tumor, on treatment with neuropathic drugs, or any other psychiatric disorder.

Data Collection

In this study, stroke was determined through history taking, physical examination, and neuroimaging studies in medical records. The definition of stroke was based on criteria from the National Guideline of Stroke Management by the Indonesia Ministry of Health 2019.[15] Data on stroke patients were obtained from a questionnaire. The questionnaire consisted of two parts. The first part asked about their socio-demographic, comorbidities, and sensory sensation abnormalities. The second part was the Indonesian version of the specific Quality of Life (SS-QoL) form to measure the quality of life of stroke patients.[16] SS-QoL consists of 49 items which provide assessment in 12 domains: Self-care, Vision, Language, Mobility, Work/ productivity, Upper extremity function, Thinking, Personality, Mood, Family role, social role, and Energy. Each item was assessed on a five-point Guttman-type scale. SS-QoL summary scores are composed of an unweighted average of the 12 domain scores. The higher scores show that the quality of life increases in positive ways. The age group consisted of elderly (61 years old and above) and non-elderly (≤60). Stroke types were

classified as ischemic and hemorrhagic based on medical records. Stroke severity was based on the National Institutes of Health Stroke Scale (NIHSS) score and categorized as mild (<5) and moderate to severe (≥5). Depression status was based on score of the Indonesian version of the Hospital Anxiety and Depression Score (HADS).[17,18] HADS was categorized as Yes (≥8) or No (score <8). Smoking habits were classified as Ever smoking (recently or ever smoked) or Not smoking. CPSP diagnosis was based on the American Pain Society 2017 criteria.[19]

Data Analysis

Statistical analyses were performed using the Statistical Package for Social Sciences Inc (SPSS) for Windows version 22. Descriptive analytical parameters were used to summarize the socio-demographic and clinical characteristics of the study participants. The different symptoms of CPSP were presented, compared, and analyzed and frequency distributions of the variable were interpreted. Continuous variables were presented as descriptive statistics such as mean±standard deviation, standard error of the mean value, and minimum-maximum value. The normality test was conducted with the Kolmogorov-Smirnnov test before proceeding to the Independent t-test that was used to compare numerical variables. Multiple linear regression with a backward selection method was executed to analyze factors that influence quality of life. A p-value <0.05 was considered statistically significant.

Ethical Approval

This study is part of a study examining the scoring system for CPSP and its use in primary health care. The study was approved by The Research and Community Engagement Ethical Committee of the Faculty of Public Health University of Indonesia (No: Ket- 28/UN2.F10. D11/PPM.00.02/2023). All patients gave their consent before enrolling in the study.

RESULTS

There were 166 stroke patients included in this study. The majority of stroke patients were male (55.4% vs 44.6%). Stroke was commonly found in the age group of non-elderly (57.2%) and dominated by ischemic type (80.7%). There 53.6% of patients were categorized as moderate to severe, and stroke mostly occurred on the left side of the body (57.8%). Pain and/or uncomfortable sensation was reported in 52.4% of stroke patients. The description of cramps and numbness sensation was commonly reported (48.2% and 31.9% respectively). In the present study, we found that a history of hypertension (90.4%), lipid disorders (61.4%), and diabetes (31.3%) were the most commonly reported comorbid of stroke. Depression was detected in 12.0% and ever smoke in 5.4%. The proportion of CPSP was found in 30.1% of stroke patients. **Table 1** shows the entire characteristics of stroke patients in this study.

Table 1. Characteristics of stroke patients

Characteristics	Total N=166	%
Gender		
Female	74	44.6
Male	92	55.4
Age group		
Elderly	71	42.8
Non-elderly	95	57.2
Stroke type		
Ischemic	134	80.7
Hemorrhagic	32	19.3
Severity of stroke		
Mild	77	46.4
Moderate to severe	89	53.6
Laterality of stroke		
Left	96	57.8
Right	70	42.2
Pain at the area of stroke		
Yes	87	52.4
No	79	47.6
Sensory abnormality		
Burning	23	13.9
Cramps	80	48.2
Freezing	3	1.8
Electric-like	12	7.2
Numbness	53	31.9
Needling	36	21.7
Pressure	10	6.0
Tingling	5	3.0
Comorbidity		
Depression	20	12.0
Diabetes	52	31.3
Lipid disorders	102	61.4
Hypertension	150	90.4
Heart disease	12	7.2
Ever smoking	9	5.4
Central post-stroke pain		
Yes	50	30.1
No	116	69.9

SS-QoL summary scores calculated for our study sample are shown in **Table 2**. Among CPSP patients, there was a significant difference in SS-QoL summary score between patients with and without pressure-like sensations. In general, among stroke patients, there was a significant difference in SS-QoL summary score based on the severity of the stroke (p-value = 0.00). The SS-QoL summary score was also significantly different between stroke patients with sensory abnormality in the form of burning, cramps, and pressure-like sensations compared with patients without these sensations. Stroke patients with depression have relatively lower SS-QoL summary scores in comparison with patients without depression, and the difference was statistically significant (p=0.02).

Table 3 shows the description of the quality of life of stroke patients in each domain. Patients with CPSP had lower scores in the domain of Thinking (3.73 vs 4.14) which was a statistically significant difference. Also in the domain of Energy, CPSP patients had significantly lower scores than non-CPSP patients (3.92 vs 4.14). However, in general, there was no difference in SS-QoL summary score between the two groups (p=0.09).

Table 2. Distribution of SS-QoL summary score among stroke patient

Characteristics	CPSP		p-value	Non-CPSP		p-value	Total		p-value
	Mean±SD	SE		Mean±SD	SE		Mean±SD	SE	
Gender									
Female	4.14±0.79	0.15	0.05	4.03±0.78	0.11	0.15	4.07±0.78	0.09	0.88
Male	3.70±0.77	0.15		4.23±0.65	0.07		4.08±0.72	0.07	
Age group									
Elderly	4.02±0.71	0.15	0.45	4.15±0.68	0.09	0.92	4.11±0.69	0.08	0.59
Non-elderly	3.85±0.87	0.16		4.14±0.74	0.09		4.05±0.79	0.08	
Stroke type									
Ischemic	3.85±0.82	0.13	0.20	4.17±0.70	0.07	0.50	4.07±0.75	0.06	0.91
Hemorrhagic	4.17±0.71	0.21		4.04±0.76	0.16		4.09±0.73	0.13	
Severity of stroke									
Mild	4.21±0.73	0.19	0.10	4.32±0.64	0.08	0.00*	4.30±0.65	0.07	0.00*
Moderate to severe	3.80±0.81	0.13		3.93±0.74	0.10		3.88±0.77	0.08	
Laterality of stroke									
Left	4.07±0.71	0.12	0.07	4.14±0.70	0.09	0.97	4.12±0.70	0.07	0.42
Right	3.56±0.91	0.23		4.15±0.72	0.09		4.02±0.80	0.09	
Pain at the area of stroke									
Yes	3.93±0.75	0.11	0.82	4.03±0.71	0.10	0.16	3.99±0.73	0.07	0.11
No	3.85±1.04	0.33		4.22±0.70	0.08		4.17±0.76	0.08	
Sensory abnormality									
Burning	3.71±0.67	0.22	0.35	3.73±0.67	0.18	0.02*	3.73±0.65	0.13	0.01*
Cramps	3.86±0.78	0.13	0.49	4.01±0.81	0.11	0.12	3.95±0.80	0.08	0.03*
Freezing	-	-	-	-	-	-	4.35±0.97	0.56	0.66
Electric-like	4.22±0.45	0.18	0.16	4.42±0.71	0.29	0.37	4.32±0.58	0.16	0.16
Numbness	4.04±0.80	0.16	0.29	4.06±0.80	0.15	0.49	4.05±0.79	0.10	0.74
Pins and needles	4.04±0.59	0.17	0.50	4.04±0.66	0.13	0.37	4.04±0.63	0.10	0.68
Pressure	2.62±0.50	0.29	0.02*	3.86±0.81	0.30	0.37	3.49±0.92	0.29	0.01*
Tingling	4.28±0.62	0.36	0.40	4.41±0.83	0.58	0.72	4.33±0.61	0.27	0.39
Comorbidity									
Depression	3.48±0.97	0.43	0.32	3.66±0.91	0.23	0.03*	3.62±0.91	0.20	0.02*
Diabetes	3.76±0.88	0.22	0.36	4.05±0.71	0.11	0.36	3.96±0.77	0.10	0.19
Lipid disorders	3.80±0.89	0.16	0.89	4.18±0.67	0.07	0.55	4.07±0.76	0.07	0.82
Hypertension	3.92±0.80	0.11	0.18	4.11±0.70	0.07	0.17	4.05±0.74	0.06	0.18
Heart disease	3.65±1.13	0.50	0.59	3.65±0.89	0.33	0.17	3.65±0.95	0.27	0.13
Ever smoking	3.37±0.83	0.41	0.25	4.02±1.19	0.53	0.81	3.73±1.04	0.34	0.15

**Significant at p-value less than 0.05*

Table 3. Quality of Life of Stroke Patients in Each Domain

Domain	Total		CPSP		Non-CPSP		p-value**
	Mean±SD	Min-Max	Mean±SD	SE	Mean±SD	SE	
Self-care	4.17±0.94	1.00-5.00	4.11±0.87	0.12	4.20±0.97	0.09	0.56
Vision	4.55±0.75	1.67-5.00	4.50±0.73	0.10	5.48±0.75	0.07	0.50
Language	4.59±0.67	2.00-5.00	4.56±0.61	0.08	4.60±0.69	0.06	0.68
Mobility	4.05±0.93	1.00-5.00	3.93±0.88	0.12	4.10±0.95	0.08	0.28
Work	4.06±1.03	1.00-5.00	3.98±1.00	0.14	4.10±1.04	0.09	0.47
Upper extremity	4.00±1.11	1.00-5.00	3.81±1.17	0.16	4.08±1.08	0.10	0.16
Thinking	4.02±1.13	1.00-5.00	3.73±1.18	0.16	4.14±1.10	0.10	0.03*
Personality	3.94±1.21	1.00-5.00	3.72±1.27	0.18	4.04±1.17	0.10	0.13
Mood	4.27±0.84	1.00-5.00	4.10±0.87	0.12	4.34±0.82	0.07	0.09
Family role	4.06±1.06	1.00-5.00	3.89±1.23	0.17	4.13±0.98	0.09	0.18
Social role	3.77±1.31	1.00-5.00	3.62±1.55	0.21	3.83±1.20	0.11	0.33
Energy	3.44±1.44	1.00-5.00	3.09±1.53	0.21	3.59±1.38	0.12	0.04*
Summary score	4.08±0.74	1.00-5.00	3.92±0.80	0.11	4.14±0.71	0.06	0.09

**Significant; **p-value for the difference in means between CPSP vs non CPSP*

In the final multivariate result, we found that patients with several factors such as depression, moderate to severe stroke, burning, and pressure-like sensation were at risk of having a lower SS-QoL summary score for the stroke patients as shown in Table 4. **Table 4** shows that for each depressed stroke patient, there was a decrease in SS-QoL score of 0.390 after controlling for variables of stroke severity, burning, and pressure-like sensations. For each stroke patient who experienced a severe stroke, a decrease in SS-QoL score of 0.635 was obtained after controlling for variables such as depression, burning, and pressure-like sensations. For each stroke patient who had a moderate stroke, there was a decrease in the SS-QoL score of 0.388 after controlling for variables such as depression, burning, and pressure-like sensations. For each stroke patient who experienced burning, there was a decrease in the SS-QoL score of 0.407 after controlling for variables of depression, severity, and pressure-like sensations. For each patient who experienced pressure-like sensations, there was a decrease in SS-QoL scores of 0.632 after controlling for the variables of depression, severity, and burning. The variable that most significantly impacted the total SS-QoL score of stroke patients was stroke severity, as indicated by the highest Beta value.

DISCUSSION

The majority of stroke patients in the present study were male, commonly found in the age group of non-elderly and dominated by ischemic type. In terms of gender, this study's results follow the results obtained by Kumar et al.[20] However other studies have found different results, where there is a higher proportion of strokes in women.[21–24] This difference can be explained because globally the prevalence of stroke is commonly balanced in both genders. At a younger age, stroke tends to be more common

Table 4. Final Model of the Factors Associated with Quality of Life among Stroke Patients

Variables	B	SE	Beta	Sig.	95% CI	
					Lower	Upper
Depression	-0.390	0.164	-0.170	0.019	-0.714	-0.065
Severity						
- Severe	-0.635	0.222	-0.212	0.005	-1.073	-0.917
- Moderate	-0.388	0.109	-0.259	0.001	-0.603	-0.172
Burning	-0.407	0.154	-0.188	0.009	-0.712	-0.102
Pressure	-0.632	0.225	-0.202	0.006	-1.077	-0.188
Constant	6.898	0.448	-	<0.001	6.014	7.783

in men with hormonal influences and other risk factors. However, prevalence becomes similar at older ages.[25,26]

The majority of stroke in younger ages in this study is also consistent with various studies that find the majority of stroke sufferers under the age of 60 years.[24,27,28] These results confirm the view that in the Asian region stroke sufferers began to be dominated by younger ages. Lifestyle changes, demographics, and health transitions contribute to this phenomenon.[29,30]

Based on the type of stroke, we found that the majority of patients had an ischemic type. This finding is consistent with various global epidemiological reports that ischemic stroke is the most common type of stroke.[21,23,31] Ischemic stroke is detected in about 85% of all stroke patients worldwide.[32] This trend is also found on the Asian continent, including Indonesia.[33] Therefore, the findings are similar to those of several studies highlighting the current global feature of stroke.

In the present study, pain sensation was reported in more than half of stroke patients. This is in line with the findings reported by Barbosa (2022) where more than half of patients complain of pain.[34] The results of this study are also within the range reported by several hospitals in Italy where in the sub-acute phase and chronic phase, pain in the area of stroke is 73%.[8] These findings confirm that pain in the area of stroke is quite prevalent, and should be detectable. This is where the role of clinicians is to actively identify the presence of pain among stroke patients.[6]

In this study, we found some important comorbidities among stroke patients. History of hypertension, lipid disorders, and diabetes were the most commonly reported comorbid of stroke. The high prevalence of hypertension among stroke patients has been classically reported and is considered a significant risk factor in stroke patients.[35] The current study also found a high proportion of dyslipidemia among stroke patients. The results of this study confirm the large proportion of dyslipidemia in stroke survivors because it is consistent with the results reported in various studies. The proportion of dyslipidemia is reported to be in the range of 56% to 85.9% as reported by several authors.[36,37] The results of this study showed that the proportion of diabetes was one-third of all stroke patients. This finding is similar to that reported in several studies where the prevalence of diabetes among stroke patients in Arabia was 37.5%. A review conducted by Tang (2017) found a prevalence of diabetes of 32.2%. Likewise, the prevalence of diabetes in stroke patients in Africa is as high as 34.2%.[38–40] Therefore, the results of the current study are consistent with various previous research results.

The present study revealed that the proportion of depression amounted to 12% of all stroke patients. This result is similar to a review by Wang (2019) that reported the prevalence was in the range of 9-34%.[41] However, according to Wang, there are significant differences in the figure for post-stroke depression. The current result is lower than the results of previous meta-analysis studies that reported the prevalence of depression in poststroke patients was in the range of 29-31% in the 5 years after stroke.[42] Variation in the reported prevalence of post-stroke depression might be influenced by research methods such as time of assessment, tools that are used, diagnosis criteria, and study design.[41]

We found the proportion of ever smoking was only 5.4%, which is quite interesting due to the well-known high proportion of smokers among stroke patients.[43–45] Several possibilities could explain the phenomenon of a low proportion of smokers among stroke patients in this study. The first is due to the high rates of comorbidities (such as obesity, hypertension, diabetes, dyslipidemia, and heart disease) in the study. Patients may have been educated about the dangers of smoking by the time they began experiencing such comorbidities, even before having a stroke. Next is the possible influence of health promotion carried out while being treated, resulting in changes in behavior. But another factor is the tendency to be biased when reporting where patients do not want to admit to having smoked because of the stigma of smoking or fear of being lectured by health workers for being in smoke-free areas. This warrants further study on this population.

The prevalence of CPSP in the present study was 30.1% of stroke patients. This prevalence is

similar to various hospital-based research results reporting prevalence in the range of 8-38.2%.[34] In general, the estimated NSPS in stroke patients is in the range of 8-55%.[10] This study validated the importance of actively detecting CPSP among stroke patients.

Based on the severity of the stroke, we found that QoL was significantly lower in moderate-severe stroke than in mild stroke patients ($p<0.001$). In addition, stroke patients with depression showed relatively lower QoL than their non-depressed counterparts ($p=0.02$). This is consistent with previous research that reported a negative impact on QoL from more severe stroke and depression.[46,47] Thus, this study also validated the negative effect of severity of stroke and depression in QoL of stroke patients, since in the multivariate analysis we found that these two factors in addition to burning and pressure-like sensation, are at risk of having a lower quality of life for the stroke patients.

Stroke patients with sensory abnormalities, such as burning sensations, cramps, and pressure-like feelings, tend to report lower levels of quality of life (QoL) compared to those who do not have such sensations. These results are in line with previous research showing that the presence of sensory abnormalities, arising from central sensory dysfunction, will significantly negatively impact overall QoL among stroke survivors. This impact is associated with the presence of discomfort and disability related to the manifestation of such sensory abnormalities.[21,48] Furthermore, in the group of CPSP patients, we found that male patients had significantly lower QoL than women. This result is not in line with previous research that among CPSP patients, females experience a greater impact on their quality of life compared to males.[49] Further study needs to be conducted to analyze and highlight a gender disparity in QoL outcomes among CPSP patients

After conducting a literature search, we have not found any other studies that use SS-QoL to evaluate QoL in patients with CPSP. From this point of view, our research can contribute to providing more options. In the current study, we found that patients with CPSP have lower scores in the domain of Thinking and Energy. This finding is consistent with previous research showing that pain can affect cognitive function and energy levels in individuals with chronic conditions.[50–52] However, we could not detect a statistically significant difference in other domains as well as the summary score between the two groups ($p=0.09$). This can be attributed to the multidimensional nature of QoL itself, where other factors such as coping mechanisms, social support, and psychological resilience can contribute to reducing the impact of CPSP on certain domains in QoL measurement.[53] Further research is needed to explore the factors that contribute to QoL in patients with CPSP.

CONCLUSION

This study highlights the prevalence of CPSP of 30.1% among stroke patients. This study also concluded that the main areas of distress that have the greatest impact on the quality of life of stroke survivors with CPSP were the domain of thinking and energy. Stroke severity, depression, burning, and pressure-like sensations are determinants of poorer quality of life among stroke patients.

ACKNOWLEDGMENTS

The authors express their sincere gratitude to the Indonesia Endowment Fund for Education (LPDP) for the financial support. The authors also extend their heartfelt appreciation to all patients and officers of Prof. Dr. R. D. Kandou General Hospital Manado, Bethesda General Hospital Tomohon, and Teling Army General Hospital Manado for their cooperation during the research.

REFERENCES

1. Feigin VL, Brainin M, Norrving B, et al. World Stroke Organization (WSO): Global Stroke Fact Sheet 2022. International Journal of Stroke. 2022;17(1):18–29; doi: 10.1177/17474930211065917.
2. Aunthakot K, Loahasiriwong W, Tiamkao S. Recurrence stroke of ischemic stroke patients in Thailand: a nationwide study. Int J Publ Health Sci. 2023;12(2):614–20; doi: 10.11591/ijphs.v12i2.22504.
3. Balitbangkes. Hasil Riskesdas 2018. Badan Penelitian dan Pengembangan Kesehatan 2019.
4. Pandian JD, Srivastava MVP, Aaron Sanjith, et al. The burden, risk factors and unique etiologies of stroke in

South-East Asia Region (SEAR). The Lancet Regional Health - Southeast Asia. 2023;17; doi: 10.1016/j.lansea.2023.100289.
5. Boehme C, Toell T, Lang W, et al. Longer term patient management following stroke: A systematic review. International Journal of Stroke. 2021;16(8):917–26; doi: 10.1177/17474930211016963.
6. Westerlind E, Singh R, Persson HC, et al. Experienced pain after stroke: A cross-sectional 5-year follow-up study. BMC Neurol. 2020;20(1):1–8; doi: 10.1186/s12883-019-1584-z.
7. Olawale OA, Ajepe TO, Oke KI, et al. Chronic pain after stroke: a hospital-based study of its profile and correlation with health-related quality of life. Middle East Journal of Rehabilitation and Health. 2016;4(1):1–6; doi: 10.17795/mejrh-41874.
8. Paolucci S, Iosa M, Toni D, et al. Prevalence and time course of post-stroke pain: A multicenter prospective hospital-based study. Pain Medicine (United States). 2016;17(5):924–30; doi: 10.1093/pm/pnv019.
9. Finnerup NB, Kuner R, Jensen TS. Neuropathic pain: From mechanisms to treatment. Physiol Rev. 2021;101(1):259–301; doi: 10.1152/PHYSREV.00045.2019.
10. Choi HR, Aktas A, Bottros MM. Pharmacotherapy to manage central post-stroke pain. CNS Drugs. 2021;35(2):151–160; doi: 10.1007/s40263-021-00791-3.
11. Singer J, Conigliaro A, Spina E, et al. Central poststroke pain: A systematic review. International Journal of Stroke. 2017;12(4):343–55; doi: 10.1177/1747493017701149.
12. Gonzales GR. Central pain: Diagnosis and treatment strategies. 1995.
13. Harrison RA, Field TS. Post stroke pain: Identification, assessment, and therapy. Cerebrovasc Dis. 2015;39:190–201; doi: 10.1159/000375397.
14. Tang WK, Liang H, Mok V, et al. Is pain associated with suicidality in stroke? Arch Phys Med Rehabil. 2013;94(5):863–866; doi: 10.1016/j.apmr.2012.11.044.
15. Kemenkes RI. Pedoman Nasional Pelayanan Kedokteran Tata Laksana Nyeri. 2019.
16. Hadiati D. Uji validitas dan reliabilitas stroke specific quality of life (Ss-Qol) berbahasa Indonesia pada pasien stroke. Fakultas Kedokteran Universitas Indonesia: Jakarta; 2014.
17. Tiksnadi BB, Triani N, Fihaya FY, et al. Validation of hospital anxiety and depression scale in an Indonesian population: A scale adaptation study. Fam Med Community Health. 2023;11(2); doi: 10.1136/fmch-2022-001775.
18. Widyadharma E, Adnyana O. Reliability Indonesian version of the hospital anxiety and depression scale (HADS) of stroke patients in Sanglah General Hospital Denpasar. 2013.
19. Widerstrom-Noga E. AAPT diagnostic criteria for central neuropathic pain. J Pain. 2017;18(12); doi: 10.1016/j.jpain.2017.06.003.
20. Kumar M, Kumar A, Saroj U, et al. A Study on the clinical profiles of patients with cerebrovascular accident (stroke) in a tertiary care hospital in Jharkhand. Cureus. 2023; doi: 10.7759/cureus.35919.
21. Bashir AH, Abdullahi A, Abba MA, et al. Central poststroke pain: Its profile among stroke survivors in Kano, Nigeria. Behavioural Neurology. 2017;2017; doi: 10.1155/2017/9318597.
22. Bhattacharyya R, Goswami S, Ghosh KC, et al. Clinical features and imaging of central poststroke pain. 2016. Available from: https://www.indianjpain.org/article.asp?issn=0970-5333;year=2016;volume=30;issue=1;spage=34;epage=37;aulast=Bhattacharyya [Last accessed: 3/5/2022].
23. Kumar A, Bhoi SK, Kalita J, et al. Central poststroke pain can occur with normal sensation. Clinical Journal of Pain 2016;32(11):955–60; doi: 10.1097/AJP.0000000000000344.
24. Mhangara CT, Naidoo V, Ntsiea MV. The prevalence and management of central post-stroke pain at a hospital in Zimbabwe. Malawi Med J. 2020;32(3):132-8; doi: 10.4314/MMJ.V32I3.5.
25. Ahangar AA, Saadat P, Heidari B, et al. Sex difference in types and distribution of risk factors in ischemic and hemorrhagic stroke. International Journal of Stroke. 2018;13(1):83–6; doi: 10.1177/1747493017724626.
26. Dotson AL, Offner H. Sex differences in the immune response to experimental stroke: Implications for translational research. J Neurosci Res. 2017;95(1–2):437–46; doi: 10.1002/jnr.23784.
27. Ru X, Wang W, Sun H, et al. Geographical difference, rural-urban transition and trend in stroke prevalence in China: Findings from a National Epidemiological Survey of Stroke in China. Sci Rep. 2019;9(1); doi: 10.1038/s41598-019-53848-1.
28. Farooq A, Tariq M, Sultan S, et al. Frequency of undiagnosed diabetes mellitus in patients presenting with acute stroke in a medical emergency. Pakistan Journal of Medical and Health Sciences. 2022;16(6):707–8; doi: 10.53350/pjmhs22166707.
29. Turana Y, Tengkawan J, Chia YC, et al. Hypertension and stroke in Asia: A comprehensive review from HOPE Asia. J Clin Hypertens (Greenwich). 2021;23(3):513–21; doi: 10.1111/JCH.14099.
30. Bang OY. Considerations when subtyping ischemic stroke in Asian patients. Journal of Clinical Neurology (Korea). 2016;12(2):129–36; doi: 10.3988/jcn.2016.12.2.129.
31. Bhattacharyya R, Goswami S, Ghosh KC, et al. Clinical features and imaging of central poststroke pain. Indian Journal of Pain. 2016;30(1):34; doi: 10.4103/0970-5333.173462.
32. Murphy SJ, Werring DJ. Stroke: causes and clinical features. Medicine (United Kingdom). 2020;48(9):561–6; doi: 10.1016/J.MPMED.2020.06.002.
33. Venketasubramanian N, Yoon BW, Pandian J, et al.

Stroke epidemiology in South, east, and south-east Asia: A review. J Stroke. 2017;19(3):286–94; doi: 10.5853/jos.2017.00234.
34. Barbosa LM, da Silva VA, de Lima Rodrigues AL, et al. Dissecting central post-stroke pain: a controlled symptom-psychophysical characterization. Brain Commun. 2022;4(3); doi: 10.1093/braincomms/fcac090.
35. Jing L, Tian Y, Ren G, et al. Epidemiological features of hypertension among ischemic survivors in Northeast China: insights from a population-based study, 2017–2019. BMC Public Health. 2021;21(1); doi: 10.1186/s12889-021-11692-x.
36. Sadekur M, Sarkar R, Hasan M, et al. Relationship of central post-stroke pain with location and type of lesions in the brain among thalamic stroke patients. Journal of National Institute of Neurosciences Bangladesh. 2022;8(1):9–13; doi: 10.3329/jninb.v8i1.59925.
37. Olamoyegun MA, Akinlade AT, Fawale MB, et al. Dyslipidaemia as a risk factor in the occurrence of stroke in Nigeria: prevalence and patterns. Pan African Medical Journal. 2016;25; doi: 10.11604/PAMJ.2016.25.72.6496.
38. Rammal SA, Almekhlafi MA. Diabetes mellitus and stroke in the Arab world. J Taibah Univ Med Sci. 2016;11(4):295–300; doi: 10.1016/j.jtumed.2016.05.001.
39. Massi DG, Doumbe J, Patouokoumche RN, et al. Outcome between diabetic versus non-diabetic acute stroke in a black African population: A cohort study. World J Neurosci. 2021;11(03):231–45; doi: 10.4236/wjns.2021.113017.
40. Tang XN, Liebeskind DS, Towfighi A. The role of diabetes, obesity, and metabolic syndrome in stroke. Semin Neurol. 2017;37(3):267–73; doi: 10.1055/s-0037-1603753.
41. Wang Z, Shi Y, Liu F, et al. Diversiform etiologies for poststroke depression. Front Psychiatry. 2019;10; doi: 10.3389/fpsyt.2018.00761.
42. Robinson RG, Jorge RE. Post-stroke depression: A review. American Journal of Psychiatry 2016;173(3):221–31; doi: 10.1176/appi.ajp.2015.15030363.
43. Pan B, Jin X, Jun L, et al. The relationship between smoking and stroke: A meta-analysis. Medicine (United States). 2019;98(12); doi: 10.1097/MD.0000000000014872.
44. Feigin VL, Roth GA, Naghavi M, et al. Global burden of stroke and risk factors in 188 countries, during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet Neurol. 2016;15(9):913–24; doi: 10.1016/S1474-4422(16)30073-4.
45. Benowitz NL, Burbank AD. Cardiovascular toxicity of nicotine: implications for electronic cigarette use. Trends Cardiovasc Med. 2016;26(6):515–23; doi: 10.1016/j.tcm.2016.03.001.
46. Shi Y, Yang D, Zeng Y, et al. Risk factors for post-stroke depression: A meta-analysis. Front Aging Neurosci. 2017;9(Jul); doi: 10.3389/fnagi.2017.00218.
47. Stein LA, Goldmann E, Zamzam A, et al. Association between anxiety, depression, and post-traumatic stress disorder and outcomes after ischemic stroke. Front Neurol. 2018;9(Nov); doi: 10.3389/fneur.2018.00890.
48. Mulla SM, Wang L, Khokhar R, et al. Management of central poststroke pain: Systematic review of randomized controlled trials. Stroke. 2015;46(10):2853–60; doi: 10.1161/STROKEAHA.115.010259/FORMAT/EPUB.
49. Harno H, Haapaniemi E, Putaala J, et al. Central poststroke pain in young ischemic stroke survivors in the Helsinki young stroke registry. 2014.
50. Munsch F, Sagnier S, Asselineau J, et al. Stroke location is an independent predictor of cognitive outcome. Stroke. 2016;47(1):66–73; doi: 10.1161/STROKEAHA.115.011242.
51. Pinzon RT, Sanyasi RDL, Totting S. The prevalence and determinant factors of post-stroke cognitive impairment. Asian Pacific Journal of Health Sciences. 2018;5(1):78–83; doi: 10.21276/apjhs.2018.5.1.17.
52. Turk DC, Fillingim RB, Ohrbach R, et al. Assessment of psychosocial and functional impact of chronic pain. Journal of Pain. 2016;17(9):T21–T49; doi: 10.1016/j.jpain.2016.02.006.
53. Lee J, Green BM, Palmarella G, et al. Negative impact of chronic pain: The role of locus of control and perceived family validation of chronic pain. Health Psychol Open. 2022;9(2); doi: 10.1177/20551029221125170.