DOI: https://doi.org/10.53350/pjmhs20231709250

ORIGINAL ARTICLE

Frequency of Polycythemia in Patients with Stroke

KAMRAN AHMAD[1], HAFIZ RAHMAN[1], JUNAID RAQIB[1], SULTANA SHAHEEN[2], MOHAMMAD IMRAN YOUNUS[3]
[1]Timergara Teaching Hospital, Dir (L), Khyber Pakhtunkhwa, Pakistan
[2]Disease Surveillance officer at WHO Gilgit Region, Pakistan.
[3]Assistant Professor, Department of Community Medicine & Public Health, Rawalpindi Medical University
Correspondence to: Hafiz Rahman, Email: hafizrehman59@gmail.com

ABSTRACT

Background: Stroke is a neurological deficit of vascular origin that persists for more than 24 hours, affecting approximately 16.9 million people annually. Among the various contributors to stroke, one is polycythaemia, characterized by an increase in red blood cell mass, often measured through hematocrit levels. Building on this, the present study aims to determine the frequency of polycythemia in patients with stroke, addressing the limited data available on the subjec.t.

Objectives: Investigate the prevalence of polycythemia in stroke patients and explore its relationship with demographic and clinical factors.

Methods: A cross-sectional, descriptive study was conducted at the Department of General Medicine, Hayatabad Medical Complex, Peshawar, from December 2020 to May 2021. To determine an appropriate sample size, 121 patients were calculated using the WHO sample size calculator. To minimize bias, strict inclusion and exclusion criteria were applied. Data were then collected from stroke patients, including blood samples for a full blood count and haematocrit level analysis. Subsequently, results were recorded in a pre-prepared proforma and analysed using IBM SPSS.

Results: Patients studied, 83.5% were male, with a mean age of 43.48 ± 9.84 years. 60.3% had ischemic stroke, and 53.7% had diabetes, 66.1% were hypertensive, and 56.2% had chronic kidney disease (CKD). The prevalence of polycythaemia was 62.0%. Further analysis revealed that polycythaemia was significantly associated with stroke type, diabetes, hypertension, CKD, and haematocrit levels ($p<0.05$), but non-significantly associated with age and gender ($p>0.05$).

Conclusion: polycythemia is prevalent among stroke patients and is significantly linked to factors like diabetes, CKD, and hypertension. These findings suggest it is crucial to consider polycythaemia and other myeloproliferative disorders in the evaluation and management of stroke patients, ensuring that these conditions are addressed to improve patient outcomes.

Keywords: Stroke, Polycythaemia, Haematocrit level, Diabetes, Hypertension, Chronic Kidney Disease

INTRODUCTION

Stroke, defined as a focal neurological deficit of vascular origin persisting for more than 24 hours, is a major global health concern affecting an estimated 16.9 million people annually[1]. In Asian countries, stroke prevalence is especially high. For example, stroke affects 1,596 per 100,000 people in China[2], 119 to 145 per 100,000 in India[3], and up to 250 per 100,000 in Pakistan[4]. Polycythemia, characterized by increased red cell mass or hematocrit level (≥48%), is a potential and underrecognized risk factor for stroke. Elevated hematocrit can increase blood viscosity, reduce cerebral blood flow, and promote thrombosis, resulting in either ischemic or hemorrhagic events[5]. Polycythemia may be primary (such as polycythemia vera) or secondary to other causes. The link between polycythemia and stroke is increasingly recognized, with studies identifying increased stroke risk and mortality in patients with elevated hematocrit[8,9,10]. However, there is a lack of data specifically quantifying the frequency of polycythemia among stroke patients, particularly in local and regional contexts. Addressing this gap is important because recognizing patients with both stroke and polycythemia can influence clinical decision-making, risk stratification, and management strategies. By determining the frequency of polycythemia in stroke patients, this study aims to provide data that could inform future screening protocols and guide tailored management to improve patient outcomes[18,19].

METHODOLOGY

The study was conducted in the Department of General Medicine at Hayatabad Medical Complex, Peshawar, over a minimum duration of six months following approval of the synopsis. This cross-sectional study aimed to assess the prevalence and impact of polycythemia in stroke patients, using nonprobability consecutive sampling to include all eligible stroke patients presenting during the study period. The sample size was calculated using the WHO formula, estimating a high hematocrit level of 19% in stroke patients, with a 7% confidence interval and 95% margin of error, resulting in a sample size of 121. The inclusion criteria encompassed patients presenting with stroke symptoms aged 30 to 70 years, of both genders, and willing to give informed consent. Exclusion criteria included patients already diagnosed with polycythemia, those with known brain tumors or mass-occupying lesions, and those undergoing treatment with cytotoxic medications. Data collection was initiated after obtaining ethical approval and involved collecting demographic details, clinical information (type of stroke), and hematological data (hematocrit levels and full blood count). The data was recorded in a pre-prepared proforma and analyzed using IBM SPSS version 23. Descriptive statistics were used to calculate the mean and standard deviation (SD) for quantitative variables, while frequencies and percentages were calculated for categorical variables. Stratification was performed based on age, gender, diabetes, hypertension, CKD, and prior stroke admissions to better understand the relationship between polycythemia and these variables. A Chi-square test was applied post-stratification to assess associations, with a p-value of ≤0.05 considered statistically significant.

Received on 25-02-2023
Accepted on 03-08-2023

RESULTS

The study found that the majority of stroke patients were male (83.5%) with a mean age of 43.48 ± 9.84 years, and most were aged between 30 and 45 years (75.2%). Ischemic strokes were more common (60.3%) than hemorrhagic strokes (39.7%). The prevalence of comorbidities was significant, with 53.7% of patients having diabetes, 66.1% having hypertension, and 56.2% suffering from chronic kidney disease (CKD). Polycythemia, defined by a hematocrit level ≥48%, was present in 62% of the patients, highlighting its potential role in stroke. The study also revealed that polycythemia was strongly associated with hemorrhagic stroke ($p=0.02$) and was significantly more prevalent in patients with diabetes ($p=0.03$), hypertension ($p=0.00$), and CKD ($p=0.00$), indicating that these conditions may contribute to the development of polycythemia. Furthermore, Polycythemic patients had significantly higher hematocrit levels (52.19 ± 3.73) compared to non-polycythemic patients (38.07 ± 5.02), confirming the association between elevated hematocrit and polycythemia in stroke patients. These findings suggest that polycythemia could be an important factor in stroke risk, particularly among those with

comorbid conditions like hypertension and CKD.

Table 1: Sociodemographic and Clinical Characteristics of Study Participants

Variable	Value
Gender - Male	101 (83.5%)
Gender - Female	20 (16.5%)
Mean Age	43.48 ± 9.84 years
Age 30–45 years	91 (75.2%)
Age 46–70 years	30 (24.8%)
Ischemic Stroke	73 (60.3%)
Haemorrhagic Stroke	48 (39.7%)
Diabetes - Yes	65 (53.7%)
Diabetes - No	56 (46.3%)
Hypertension - Yes	80 (66.1%)
Hypertension - No	41 (33.9%)
CKD - Yes	68 (56.2%)
CKD - No	53 (43.8%)
Polycythemia - Yes	75 (62.0%)
Polycythemia - No	46 (38.0%)
Mean Haematocrit Level	46.82 ± 8.09

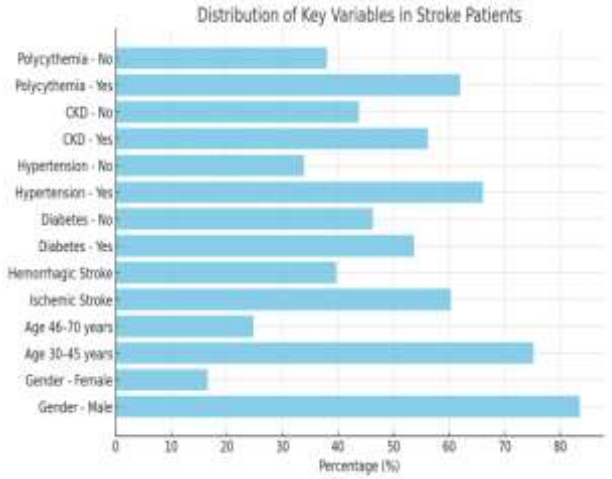


Table 2: Stratification of Polycythemia by Demographics and Stroke Type

Stratification Variable	Polycythemia – Yes	Polycythemia – No	P-value
Male	61	40	0.46
Female	14	6	
Age 30–45	52	39	0.08
Age 46–70	23	7	
Ischemic Stroke	39	34	0.02
Hemorrhagic Stroke	36	12	

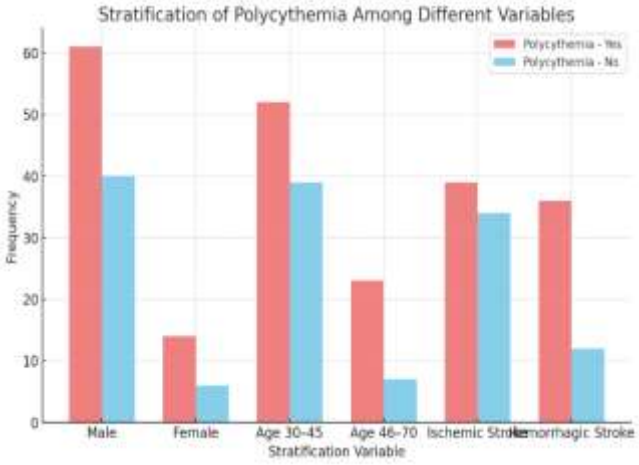
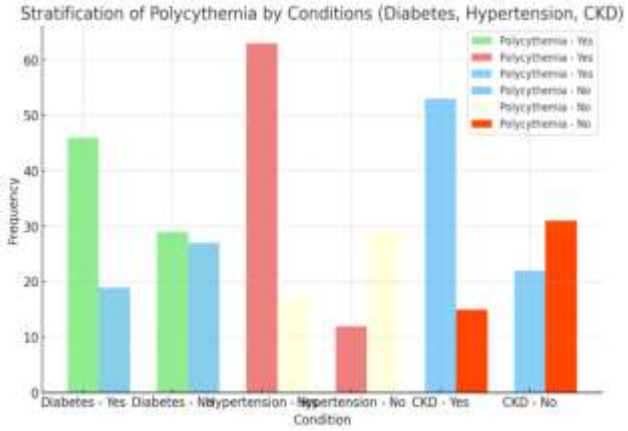


Table 3: Stratification of Polycythemia by Comorbidities

Condition	Polycythemia – Yes	Polycythemia – No	P-value
Diabetes - Yes	46	19	0.03
Diabetes - No	29	27	
Hypertension - Yes	63	17	0.00
Hypertension - No	12	29	
CKD - Yes	53	15	0.00
CKD - No	22	31	



DISCUSSION

Stroke remains a significant global health burden, ranking as the third leading cause of death. Various hematologic disorders, including polycythemia, increase the risk of stroke due to thrombotic complications. In this study, males aged 30–45 constituted the majority, although polycythemia vera often peaks between ages 50–70 but can occur at any age. Previous data show a higher male predominance and median diagnosis ages of 60 for men and 62 for women. Polycythemia vera's annual incidence is about 1 in 100,000, with men forming the majority of cases. Thrombotic events, such as stroke and TIA, account for most arterial complications at diagnosis. In our sample, 60.3% had ischemic and 39.7% had hemorrhagic stroke, similar to previous findings. Primary polycythemia shows more cardiovascular disease (43%) than secondary polycythemia (8%), but hematocrit levels alone cannot distinguish risk. Age and increased leukocyte counts are established stroke risk factors in polycythemia. Our results also confirm high rates of diabetes (53.7%), hypertension (61%), and polycythemia (62%). Comparisons with previous studies reveal parallel patterns in comorbidity frequencies and reinforce the linked risks of diabetes, hypertension, and polycythemia in stroke patients.

CONCLUSION

This study demonstrates that polycythemia is common among stroke patients and is significantly associated with diabetes, chronic kidney disease, and hypertension.

Polycythemia and other myeloproliferative disorders should be considered when evaluating stroke cases and addressed in management. Future research on stroke risk factors, etiologies, and current treatments is recommended to improve prevention and management strategies for polycythemia in stroke patients.

Author Contributions:

Dr Kamran Ahmad contributed to the study design, data analysis, and manuscript preparation.

Dr Hafiz Rahman was involved in the data collection, interpretation of results, and writing the manuscript.

Dr Junaid Raqib contributed to the data analysis and the writing of the manuscript.

Sultana Shaheen assisted with data collection and provided critical feedback on the manuscript.

Prof Dr Mohammad Imran Younus provided expertise in the study design, interpretation of results, and manuscript review.
Funding Source: No funding was received for this study.
Conflict of Interest: The authors declare that there are no conflicts of interest regarding the publication of this article.
Acknowledgments: The authors would like to thank the Department of General Medicine at Hayatabad Medical Complex, Peshawar, for their support in facilitating this study.

REFERENCES

1. Feigin, V. L., Forouzanfar, M. H., Krishnamurthi, R., Mensah, G. A., Connor, M., Bennett, D. A., et al. (2014). Global and regional burden of stroke during 1990–2010: Findings from the Global Burden of Disease Study 2010. Lancet, 383(9913), 245–255.
2. Wang, W., Jiang, B., Sun, H., Ru, X., Sun, D., Wang, L., et al. (2017). Prevalence, incidence, and mortality of stroke in China: Results from a nationwide population-based survey of 480,687 adults. Circulation, 135(8), 759–771.
3. Pandian, J. D., & Sudhan, P. (2013). Stroke epidemiology and stroke care services in India. Journal of Stroke, 15(3), 128.
4. Hashmi, M., Khan, M., & Wasay, M. (2013). Growing burden of stroke in Pakistan: A review of progress and limitations. International Journal of Stroke, 8(7), 575–581.
5. Taylor, A., Alakbarzade, V., Chandratheva, A., Simister, R., & Scully, M. (2018). The importance of the full blood count in cerebral ischemia: A review of 609 consecutive young patients with stroke and transient ischemic attacks. Journal of Stroke and Cerebrovascular Diseases, 27(9), 2500–2504.
6. Sico, J. J., Myers, L. J., Fenton, B. J., Concato, J., Williams, L. S., & Bravata, D. M. (2018). Association between admission hematocrit and mortality among men with acute ischemic stroke. Stroke Vascular Neurology, 3(3), 160–168.
7. Berchie, P. O., Sarfo, F. S., Opare-Sem, O. K., & Ovbiagele, B. (2019). Recurrent stroke in a Ghanaian patient with polycythemia. Journal of Stroke and Cerebrovascular Diseases, 28(3), 850–852.
8. Garge, S., Vyas, P., Modi, P., Ghatge, S., & Choudhary, M. (2016). Polycythemia vera with advanced atherosclerosis and cerebral ischemic stroke: A case report. PJR, 22(4).
9. Corse, A. K., & Kurtis, H. (2018). Ischemic stroke caused by secondary polycythemia and incidentally-found renal cell carcinoma: A case report. American Journal of Case Reports, 19, 638.
10. Abdel-Rahman, I., & Murphy, C. (2015). Recurrent ischemic stroke unveils polycythemia vera. BMJ Case Reports, 2015, bcr2014207625.
11. Gaillard, F. (2018). Ischemic stroke. Radiopaedia.org. Retrieved from https://radiopaedia.org
12. Donnan, G. A., Fisher, M., Macleod, M., & Davis, S. M. (2017). Stroke. Lancet, 371(9624), 1612–1623.
13. National Heart, Lung, and Blood Institute. (2014). What are the signs and symptoms of stroke? Retrieved from https://www.nhlbi.nih.gov
14. Martin, G. (2017). Palliative Care Nursing: Quality Care to the End of Life (3rd ed.). Springer Publishing Company.
15. National Heart, Lung, and Blood Institute. (2015). What is a stroke? Retrieved from https://www.nhlbi.nih.gov
16. National Heart, Lung, and Blood Institute. (2014). Who is at risk for a stroke? Retrieved from https://www.nhlbi.nih.gov
17. Hu, A., Niu, J., & Winkelmayer, W. C. (2018). Oral anticoagulation in patients with end-stage kidney disease on dialysis and atrial fibrillation. Seminars in Nephrology, 38(6), 618–628.
18. National Heart, Lung, and Blood Institute. (2014). How is a stroke diagnosed? Retrieved from https://www.nhlbi.nih.gov
19. Yew, K. S., & Cheng, E. (2009). Acute stroke diagnosis. American Family Physician, 80(1), 33–40.
20. Global Burden of Disease 2015 Disease and Injury Incidence and Prevalence Collaborators. (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: A systematic analysis for the Global Burden of Disease Study 2015. Lancet, 388(10053), 1545–1602.
21. Global Burden of Disease 2015 Mortality and Causes of Death Collaborators. (2016). 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, 388(10053), 1459–1544.
22. National Heart, Lung, and Blood Institute. (2014). Types of strokes. Retrieved from https://www.nhlbi.nih.gov
23. Roos, K. L. (2017). Emergency Neurology. Springer Science & Business Media.
24. Wityk, R. J., & Llinas, R. H. (2012). Stroke. ACP Press.
25. Feigin, V. L., Rinkel, G. J., Lawes, C. M., Algra, A., Bennett, D. A., van Gijn, J., & Anderson, C. S. (2005). Risk factors for subarachnoid hemorrhage: An updated systematic review of epidemiological studies. Stroke, 36(12), 2773–2780.
26. Global Burden of Disease Study 2013 Collaborators. (2015). Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. Lancet, 386(9995), 743–800.
27. Feigin, V. L., Forouzanfar, M. H., Krishnamurthi, R., Mensah, G. A., Connor, M., Bennett, D. A., et al. (2014). Global and regional burden of stroke during 1990–2010: Findings from the Global Burden of Disease Study 2010. Lancet, 383(9913), 245–254.
28. National Institute of Neurological Disorders and Stroke. (2009). Brain basics: Preventing stroke. Retrieved from https://www.ninds.nih.gov
29. World Health Organization. (1978). Cerebrovascular Disorders (Offset Publications). Geneva: World Health Organization.
30. Kidwell, C. S., & Warach, S. (2003). Acute ischemic cerebrovascular syndrome: Diagnostic criteria. Stroke, 34(12), 2995–2998.

This article may be cited as: Ahmad K, Rahman H, Raqib J, Shaheen S, Younus MI: Frequency of Polycythemia in Patients with Stroke. Pak J Med Health Sci, 2023;18(9): 250-252.