Frequency of Hemorrhagic and Ischemic Patients of Cerebrovascular Accident (Stroke), Diagnosed on CT-Scan

Sara Sajjad[1], Muhammad Nauman Saleem[2]

ISSN: 2790-6094
P-ISSN: 2957-4587

ARTICLE INFORMATION

Corresponding Author:

- naumansaleem77@gmail.com

Affiliations:

[1]Department of Allied Health Sciences, FMH College of Medicine & Dentistry, Shadman Lahore

[2]University Institute of Radiological Sciences & Medical Imaging Technology, University of Lahore

Citation:
Received: 04-08-2023
Revised and Accepted: 24-01-2024
Published On-Line:21-02-2024

ABSTRACT

Aim: To evaluate the frequency of ischemic and hemorrhagic stroke on computed tomography and evaluate clinical manifestation related with Hemorrhagic stroke and ischemic stroke.

Methodology: A retrospective study was Performed in which 77 patients were taken to get required results. After informed consent the entire patient's data had been collected from the indoor, outdoor, and emergency department of DHQ Hospital of Okara, data was collected through the Toshiba Aquilion 16 multi detector CT scanner.

Results: Total of 77 patients diagnosed with stroke were included, 40 patients were male and 37 patients were female. Most of the patients were of age 50 to 70. Results concluded that patients with ischemic stroke were 25 in which female patients were 10, and 15 male. Furthermore, 17 patients were diagnosed with hemorrhagic stroke, in which 8 patients were female, and 9 male. Study excluded 35(45.45%) patients who were classified as stroke from other causes. In stroke, the rate of Ischemic stroke was significantly higher than hemorrhagic stroke (p=0.039).

Conclusion: In current study numerous clinical indications of different types of cerebrovascular accident were assessed in order to distinguished hemorrhagic and ischemic stroke. This comparative study was to be in the favor of Ischemic stroke as compared to hemorrhagic stroke (Ischemic stroke>Hemorrhagic stroke). Though these result provided trustworthy signs for differentiation of stroke types. For diagnosis of stroke imaging modality is still the gold standard.

Key words: CT, Hemorrhagic stroke, Ischemic Stroke, Stroke, Cerebrovascular accident.

JBAHS Work Licensed Under 4.0, Based on a work at http://jbahs.pk.
Creative Commons License Online Research Publications by authors is licensed under a Creative Commons Attribution-Non-commercial, No Derivatives 4.0 International License.

Original Research Article

Introduction:

Stroke patients with hemorrhage (HS) and ischemia (IS) were measured on the basis of stroke extremity, seriousness, mortality and cardiovascular causes.(1) In United State, Stroke is 3rd leading death causing disease after other major diseases like heart attacks and cancers (2) Stroke is common cause of dysfunction in survivors, where twenty percent of patients need medical treatment in few months after cerebrovascular accident occur. Beside this, CVA use a major percentage of health care system budget (3). In 1994, Matchar and Duncan declared that every year residents of Americans undergo 550000 strokes, which leads to 150000 demises and leaving 300000 survivors paralyzed. (4) Stroke and heart diseases, a statistical updates of the American Heart Association published in which they said 500000 Americans undergo firstly or repeated stroke every year. These two reports were derived from the white cohort study of Framingham, Mass (5).

According to the institute of health metrics, stroke is leading cause of death in Pakistan, where socioeconomic and health facilities services is becoming better there should be decrease in this cause but it is increasing with increasing number of patients with hypertension and diabetes.(6) Stroke is common in world including 7-8% of American Indians, 2.8 percent in Hispanics, and 1.5 percent in Asians. Furthermore, as compared to Europe, Asia has a higher incidence of stroke-related disabilities. Ischemic stroke occurs 75% to 80, whereas 8% to 20 of time hemorrhagic stroke happens (7).

Cerebrovascular accidents are divided into two main classifications hemorrhagic and ischemic. The Ischemic strokes are triggered due to blockage of blood supply and the hemorrhagic strokes are initiated by blood vessel rupturing or due to abnormal vascular structure. (8) Approximately 87% cerebrovascular accidents are caused by Ischemia, and the remainders are caused because of hemorrhage. It is seen that some of the hemorrhages progress inside areas of ischemia ("hemorrhagic transformation"). (9) Blood supply to the portion of brain is reduced in an ischemic stroke which leads to brain tissue dysfunction in that zone. (10) Cerebrovascular accident without recognizable explanation is known as "cryptogenic". This is about 30-40 percent of all ischemic strokes. (11) Hemorrhagic stroke may happen after blood vessels in brain erupt thus causing bleeding. Subarachnoid hemorrhage and intracerebral hemorrhage are the two types of hemorrhagic stroke. (12). Most important type of extra axial hemorrhage is

subdural hematoma, epidural hematoma and subarachnoid hemorrhage.

Cerebrovascular Accident is speedy damage to brain normal role because of disruption in brain blood supply. Brain cell necrosis afterward the occurrence of stroke is considered as unexpected cause of clinical indications of important loss of cerebral activity that lasts more than 24 hours. [13] It also causes demise of patient with no clear cause other than vascular reason (ischemia and hemorrhagic. [14, 15] Symptoms may depend on brain area damaged. If wider region of the brain is damaged by CVA, it is likely that more functions of body are lost. In some conditions of the strokes can cause other symptoms. It is seen that many forms of stroke are not linked with headache except cerebral venous thrombosis and subarachnoid hemorrhage and frequently intracerebral hemorrhage. [16]

Strokes are identified through several different methods: Computed tomography scans (mostly without contrast enhancements), neurological examination mainly the NIHSS, or Magnetic resonance imaging scans. Imaging techniques also helps in defining the different types or causes of stroke. There are however no blood tests for the stroke identification, however blood tests are helpful in finding out the likely reason of stroke. [17] CT scan is very accurate for the representation of hemorrhagic lesions. Important role of non-contrast Computed tomography is the detection of hemorrhage or other possible cause which may mimic stroke that might be cause of the brain insufficiency. [18]. Furthermore, it is non-invasive modality and it is under practice to diagnose the cause of hemorrhage, also help to measure the size of hematoma and involvement of subarachnoid, or subdural, intra-ventricular fluid, [19].

The epidemiology of ischemic and hemorrhagic stroke is an ongoing investigation to identify risk factors, which continues to expand with technological advances and preventative medical practices. A critical step in determining stroke type is identifying risk factors that can or cannot be modified. Once the risk factors are identified, modifiable risk factors can be addressed to lower the risk of stroke. Although ischemic or hemorrhagic events in Cerebrovascular accident patients are common, they can be fatal. There is little information available about the characterization of this complication. This study will aid in differentiating the cause and risk factors of CVA, as well as evaluating the frequency of hemorrhagic or ischemic patents in CVA and providing information on disease progression, complication development, and intervention effectiveness. All this information is particularly useful in assessing the physiological effect of acute ICH, and it is not available from a clinical examination alone. Because of lack of resources, CT scans cannot be repeated in rural locations. For doctors estimating physiological result from CT scan of brain done during patient sign and symptoms is important task

Methodology:

Observational descriptive study was carried out in radiology department of DHQ Hospital of Okara on frequency of hemorrhagic and ischemic patients of cerebrovascular accident (stroke), diagnosed on Ct-scan. Duration of the study was 4 months (From November 2022 to February 2023 after the approval of synopsis, Ethical Letter from intuitional review board issued with reference number AAI/OSA/2022550) in which data is collected by using specially created Performa. In which total of 77 patients were included using non convenient sampling technique, of both genders presenting with stroke. Inclusion criteria for sampling was defined such as patients presenting with the history of hypertension, diabetes and headache were selected for study Patients presenting with the clinical symptoms of aphasia, fits and altered state of conscious were also included in study

But patients presenting with the symptoms of Parkinson disease, chronic cerebral disease and other neurologic defect were not included and patients presenting with not well-defined symptoms of stoke were also exclude from study. Examination and demographic data were recorded after taking permission of patients on written consent forms. All patients were scan on CT scanner using Toshiba Aquilian 64 slice model, brain normal and contrast study carried out. Data was arranged and evaluated with the help of SPSS version 21 and MS excel 2012. Data was described using descriptive statistics and chi square test.

Results:

Total 77 patients with Stroke were involved in this research. Age of the majority of the patients were 50 to 70 years. The mean age of the patients were 55.87 ± 20.98 SD. Out of 77 patients, there were 40(51.9%) males and 37(48.1%) were females. Percentage of patients with hypertension were 57.1%, in which female were more than male and patients with diabetes mellitus were 46 %.23% patients had dyslipidemia and 22 percent patients were chain smoker. 36.3 % patients were present with symptoms of altered state of conscious and 29.8 % patients had headache. Percentage of patients with aphasia was 16.8% and with seizure 10.3 %. It was diagnosed that; hemorrhagic stroke was present in 17 patients (22.07%) and ischemic stroke in 25 patients (32.46%) as shown in table 4. And 35 patients (45.45%) were classified as stroke from other causes.

In 77 patients, Mean age of the patients was 55 years with Standard deviation 20.9, minimum age of the patient was 32 year and maximum age was 79 year. Previous research on the ability of ultrasound to detect kidney calculi has yielded similar results to present research. Maryam et al. found the diagnosis rate to be 67.83%, the PPV to be 79.66%, the NPV to be 55.36 %, and the sensitivity to be 65% 16. According to the study by Aqsa Rao et al., 121 individuals were examined, and research findings were in complete agreement with theirs. 82 (67.2%) of the group's 121 individuals were female, while 39 (32.8%) were male. 60 patients (40.6%) were not diagnosed ureteric calculi based on ultrasonographic findings, while 61 patients (50.4%) were. Even though ureteric calculi have been reported (90.9%), CT only detected them in 11% of individuals. ($p<0.05$). Accuracy for transabdominal ultrasound was 58.68%, sensitivity was 58.62%, specificity was 56.76%, PPV was 51.52%, and NPV was 63.64%. [17]

One of the benefits of research was the use of non-enhanced CT as the reference standard, which is currently the gold standard for identifying kidney calculi. Additionally, study increased the transferability of findings by evaluating ultrasound's ability to detect kidney calculi in a clinical setting. However, study investigation was not without faults. Results may not be pertinent to a larger population because sample size was so small. Research was limited in its applicability because it was conducted at a single institution.

Statistics		
Age		
N	Valid	77
	Missing	0
Mean		55.8700
Std. Deviation		20.988
Minimum		32.00
Maximum		79.00

Table 1: Age of Patients

The below mentioned cross-tabulation and Bar-Graph table illustrated the distribution of common risk factors among patients categorized by gender. Notably, hypertension and diabetes mellitus were more prevalent in females, with 23 females having hypertension and 20 having diabetes compared to 21 males with hypertension and 16 with diabetes. Percentage of patients with hypertension was 57.1%, in which female was more than male and patients with diabetes mellitus were 46 %. 23% patients had dyslipidemia and 22 percent patients were chain smoker. (Table 2)

Risk Factors			
	Present in Male	Present in Female	Total
Hypertension	21	23	44
Diabetes Mellitus	16	20	36
Dyslipidemia	5	13	18
Smoking	17	0	17

Table 2: Presence of risk factors in patients

Below mentioned bar-graph of clinical symptoms showed that 36.3 % patients were present with symptoms of altered state of conscious and 29.8 % patients had headache. Percentage of patients with aphasia was 16.8% and with seizure 10.3 %. Some patients had multiple risk factors. This tabular presentation provided the distribution of clinical symptoms based on gender, aiding in the identification of potential gender-specific patterns in the manifestation of these symptoms within the studied patient population. (Table 3)

Clinical Symptoms			
	Present in Male	Present in Female	Total
Seizure	7	1	8
Altered state of conscious	15	13	28
Headache	9	14	23
Aphasia	5	8	13

Table 3: Clinical Symptoms in Patients

The below presented cross-tabulation and bar-graph revealed the association between gender and the occurrence of infarction and hemorrhage in a patient population. Out of 77 patients, 25 patients (32.46%) had infarction and 17 patients (22.07%) had hemorrhage. Among males, 15 individuals exhibit infarction and 9 show hemorrhage, contributing to a total of 25 cases. In contrast, among females, 10 individuals had infarction and 8 have hemorrhage, resulting in a total of 18 cases. This breakdown suggested a potential gender-related difference in the prevalence of these cerebrovascular events. Analyzing the table, it appeared that infarction was more prevalent in males, while hemorrhage occurs at a slightly higher rate in females. In patients with cerebrovascular accident, the rate of Ischemic stroke was significantly higher than hemorrhagic stroke (p=0.039). IS>HS (Table 4)

Association b/w Gender and Infarction, Hemorrhage			
	Present in Male	Present in Female	Total
Infarction	15	10	25
Hemorrhage	9	8	17

Table 4: Association b/w gender and infarction, hemorrhage

Below mentioned table showed 37 cases where both infarction and hemorrhage were not present, 15 cases where infarction was not present but hemorrhage was, 23 cases where infarction is present but hemorrhage was not, and 2 cases where both infarction and hemorrhage were present. This showed that only 2 patients had infarction out of total of 17 hemorrhagic. (Table 5)

Infarction and Hemorrhage Cross tabulation				
		Hemorrhage		Total
		Not Present	Present	
Infarction	Not Present	37	15	52
	Present	23	2	25
Total		60	17	77

Table 5: Association b/w infarction and hemorrhage

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.265a	1	.039		
Continuity Correctionb	3.139	1	.076		
Likelihood Ratio	4.877	1	.027		
Fisher's Exact Test				.044	.033
Linear-by-Linear Association	4.209	1	.040		
N of Valid Cases	77				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.52.					
b. Computed only for a 2x2 table					

Table 6: Findings

The table illustrated the counts of cases based on the presence or absence of infarction and hemorrhage. Various statistical tests were employed to assess the significance of the association. The Pearson Chi-Square test yielded a value of 4.265 with a corresponding p-value of 0.039, suggested a statistically significant association between infarction and hemorrhage. Additional tests, such as Fisher's Exact Test, also supported this association with a p-value of 0.044. Symmetric measures, specifically Pearson's R and Spearman Correlation, indicated a negative correlation of -0.235 between interval and ordinal variables, respectively. These findings collectively suggest a significant relationship between infarction and hemorrhage.

Discussion:

In a cross-sectional study involving 77 patients diagnosed with stroke, 51.9% were male, and 48.1% were female. The majority of patients were in the 50 to 70 years age range. The study identified that 32.46% had ischemic stroke, 22.07% had hemorrhagic stroke, and 45.45% were classified under other stroke causes and were excluded. The analysis revealed a significantly higher rate of ischemic stroke compared to hemorrhagic stroke in patients with cerebrovascular stroke (p=0.039).

Abdul Sahto et al. in his cross sectional study, about 160 patients with hypertension were included and frequency of hemorrhagic stroke and ischemic patients and risk factors associated with them are rule out. Previous research findings, hemorrhagic stroke were detected in 55 (34%) patients and ischemic stroke were identified in 66% (105) patients. Hypertension was present in both types of stroke. Symptoms such as dyslipidemia, diabetes, and smoking were ominously high in hemorrhagic stroke as compared to in ischemic stroke. It was identified that Prevalence of ischemic stroke is high in population as compared to hemorrhagic stroke which support the study that the hypertension is main the risk factor and percentage of ischemic stroke is higher than hemorrhagic stroke [(20)]. This research results are also supported by another retrospective research which was conducted by Hassen Abdu et al. in 2021. In which compared the ischemic and

hemorrhagic stroke in 312 patients, according to the study 65.4% (204) patients had ischemic stroke [21].

PK Chhetri et al. in 2012 conduct research in which he evaluated the patients with cerebrovascular stroke on Computed Tomography. In his study numbers of patients were 100 in which 64 patients had ischemic infarction and other patients had intracranial hemorrhage. 77 percent of patient with stroke had risk factors. Among these risk factors, most common was smoking which was seen in 38 cases (38%), followed by hypertension in 28 cases (28%), This study finding was also in line with previous findings of Pk Chhetri et al. findings, in our study 57% patients present with hypertension and 22 % patients was chain smoker [22]. In general, the estimated overall findings in the current study are considered within the range of several recent studies

Conclusion:

In this study, the aim was to differentiate between hemorrhagic and ischemic stroke by excluding other types of cerebrovascular accidents. The comparative analysis was designed to favor ischemic stroke over hemorrhagic stroke (IS > HS). While these findings offer significant indications for distinguishing between the two types of strokes, it is important to note that imaging modalities, particularly computed tomography, serve as the gold standard for stroke diagnosis.

Conflict of Interest:

There is no conflict of interest

Source of Funding:

There is no funding for this research article

References:

1. Andersen KK, Olsen TS, Dehlendorff C, Kammersgaard LP. Hemorrhagic and ischemic strokes compared: stroke severity, mortality, and risk factors. Stroke. 2009;40(6):2068-72.
2. Ingall T. Stroke-incidence, mortality, morbidity and risk. JOURNAL OF INSURANCE MEDICINE-NEW YORK THEN DENVER--. 2004;36:143-52.
3. Ojaghihaghighi S, Vahdati SS, Mikaeilpour A, Ramouz A. Comparison of neurological clinical manifestation in patients with hemorrhagic and ischemic stroke. World journal of emergency medicine. 2017;8(1):34.
4. Williams GR. Stroke: incidence, survival and cost-effectiveness of treatment with ancrod: Boston University; 2000.
5. Williams GR, Jiang JG, Matchar DB, Samsa GP. Incidence and occurrence of total (first-ever and recurrent) stroke. Stroke. 1999;30(12):2523-8.
6. Khealani BA, Hameed B, Mapari UU. Stroke in Pakistan. Journal of the pakistan medical association. 2008;58(7):400.
7. Shiber JR, Fontane E, Adewale A. Stroke registry: hemorrhagic vs ischemic strokes. Am J Emerg Med. 2010;28(3):331-3.
8. Jadhav AP, Desai SM, Kenmuir CL, Rocha M, Starr MT, Molyneaux BJ, et al. Eligibility for endovascular trial enrollment in the 6-to 24-hour time window: analysis of a single comprehensive stroke center. Stroke. 2018;49(4):1015-7.
9. Fatahzadeh M, Glick M. Stroke: epidemiology, classification, risk factors, complications, diagnosis, prevention, and medical and dental management. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006;102(2):180-91.
10. Shuaib A, Hachinski VC. Mechanisms and management of stroke in the elderly. Cmaj. 1991;145(5):433-43.
11. Byrne D, Walsh J, Schmiedeskamp H, Settecase F, Heran M, Niu B, et al. Prediction of hemorrhage after successful recanalization in patients with acute ischemic stroke: improved risk stratification using dual-energy CT parenchymal iodine concentration ratio relative to the superior sagittal sinus. American Journal of Neuroradiology. 2020;41(1):64-70.
12. Zhang Y, Tuomilehto J, Jousilahti P, Wang Y, Antikainen R, Hu G. Lifestyle Factors and Antihypertensive Treatment on the Risks of Ischemic and Hemorrhagic Stroke. Hypertension. 2012;60(4):906-12.
13. Kalaria RN, Akinyemi R, Ihara M. Stroke injury, cognitive impairment and vascular dementia. Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease. 2016;1862(5):915-25.
14. Grysiewicz RA, Thomas K, Pandey DK. Epidemiology of ischemic and hemorrhagic stroke: incidence, prevalence, mortality, and risk factors. Neurol Clin. 2008;26(4):871-95, vii.
15. Sims NR, Muyderman H. Mitochondria, oxidative metabolism and cell death in stroke. Biochim Biophys Acta. 2010;1802(1):80-91.
16. Ruíz DSM, Murphy K, Gailloud P. 320-Multidetector row whole-head dynamic subtracted CT angiography and whole-brain CT perfusion before and after carotid artery stenting. European journal of radiology. 2010;74(3):413-9.
17. Ramirez-Lassepas M, Cipolle RJ, Bjork RJ, Kowitz J, Snyder BD, Weber JC, et al. Can embolic stroke be diagnosed on the basis of neurologic clinical criteria? Archives of neurology. 1987;44(1):87-9.
18. Chhetri PK, Raut S. Computed tomography scan in the evaluation of patients with stroke. Journal of College of Medical Sciences-Nepal. 2012;8(2):24-31.
19. Hatano S. Experience from a multicentre stroke register: a preliminary report. Bull World Health Organ. 1976;54(5):541-53.
20. Sahto AA, Shahzad A. ISCHEMIC AND HEMORRHAGIC STROKE;: A COMPARATIVE STUDY TO ASSESS THE FREQUENCY OF ISCHEMIC AND HEMORRHAGIC STROKE AND ASSOCIATED RISK FACTORS IN PATIENTS WITH HYPERTENSION. The Professional Medical Journal. 2019;26(02):253-9.
21. Abdu H, Tadese F, Seyoum G. Comparison of Ischemic and Hemorrhagic Stroke in the Medical Ward of Dessie Referral Hospital, Northeast Ethiopia: A Retrospective Study. Neurology Research International. 2021;2021:9996958.
22. Chhetri PK, Raut S. Computed tomography scan in the evaluation of patients with stroke. Journal of College of Medical Sciences-Nepal. 2012;8.