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Clinical and etiological profile of stroke in Uttarakhand: A hospital based retrospective study.

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Abstract

Objective: *There are numerous risk factors for cerebrovascular accidents, some of which are modifiable while others are non-modifiable. Controlling these risk variables intensively can reduce disease incidence, mortality, and morbidity. The study's main objective is to identify cerebrovascular accident subtypes admitted to the hospital and the associated risk factors.*

Materials and methods*: After authorization from the Medical Superintendent, Himalayan Hospital's Medical Record Department provided retrospective data (Jan 2018–May 2018) for this investigation. All 2018 cerebrovascular accident patients admitted to the Neurology ward, ICU, General medicine ward, and other critical care units had their hospital records examined. The risk factors like age, smoking, hypertension, diabetes, alcohol use, and dyslipidaemia were collected. The patient's CT scan and MRI were obtained from hospital medical records.*

Results: *The 50–60-year age group has the highest cerebrovascular accident rate, followed by 60–70-year. Most patients were male (63.4%), while 36.6% were female. Most cerebrovascular accidents were ischemic (63.4%), followed by haemorrhagic (36.6%). The primary risk factors were hypertension (67.8%), smoking (37.9%), alcohol consumption (34.9%), type 2 diabetes (28.9%), cardiac disease (26.5%), and dyslipidaemia (17.5%). Most ischemic cerebrovascular accidents occurred in MCA (36.9%), followed by PCA (20.5%) and ACA (5.7%).*

Conclusion: *Ischemic cerebrovascular accidents are the most common type of cerebrovascular accident. Large vessel cerebrovascular accident is the most prevalent ischemic cerebrovascular accident, followed by small vessel and cardioembolic cerebrovascular accident. Hypertension is the leading risk factor for all cerebrovascular accidents, followed by smoking, alcohol, and diabetes. Ischemic cerebrovascular accidents*

generally involve the MCA territory.

Key words: *Ischemic cerebrovascular accident, Haemorrhagic cerebrovascular accident, Risk factors, Territory, Large vessel.*

Introduction

Cerebrovascular accidents rank as the second most common cause of death and the third leading cause of morbidity globally. The Global Burden of Disease Study 2010 indicated a worldwide incidence of 16 million cases, predominantly concentrated in low- and middle-income countries. Recent data from the Global Burden of Disease indicates that in 2019, there were a total of 101 million prevalent cases of cerebrovascular accidents and 143 million disability-adjusted life years (DALYs) attributed to cerebrovascular accidents globally[1]. The risk factors may vary depending on the race and ethnicity of the patient [2]. The estimated prevalence of cerebrovascular accident in India is reported to range from 121 to 150 per 100,000 individuals [2]. The elevated rates of death and illness linked to this disease necessitate a focus not only on the prompt and comprehensive treatment of affected individuals, but also on the proactive measures taken to avoid the occurrence of the disease. The control of risk variables in the early stages of the disease can lead to the achievement of this outcome [3].

Cerebrovascular accident is linked with a range of risk factors, which can be categorized as either modifiable or non-modifiable. Additionally, factors such as age, gender, and genetics play significant roles. Factors associated with increased risk of various health conditions include smoking, hypertension, diabetes, alcohol consumption, and dyslipidemia. In particular, hypertension was identified as an important risk factor. Diabetes mellitus, alcohol consumption, and dyslipidaemia are all examples of modifiable risk factors [4]. Implementing a rigorous management of these risk variables can lead to a reduction in the occurrence, as well as the mortality and morbidity rates, associated with the ailment. According to reports, early control of risk variables has been associated with a reduction in death rates [3,5]. Nevertheless, the collective impact of these risk factors and the limited awareness among the Indian populace has resulted in the delayed recognition of those who are at risk [6, 7]. This underscores the importance of employing efficient technologies for the identification of risk variables and the assessment of the cumulative risk of cerebrovascular accident in these individuals.

Several studies conducted in India have examined the risk variables associated with cerebrovascular accident, while there are some studies on the same in the state of Uttarakhand [8].

The main objective of this study was to determine the distribution of cerebrovascular accident subtypes among patients admitted to the Himalayan Hospital. The secondary aim was to identify the risk factors associated with different types of cerebrovascular accidents.

Methodology

Study Design: Retrospective study

Study Population: The data of the all-Cerebrovascular accident patients admitted during the year 2018 to the Neurology ward, ICU, General medicine ward and other critical care-based wards and units were collected.

Study Subject: All cerebrovascular accident subjects admitted to the Himalayan hospital for the complaints of the cerebrovascular accident were considered for this study.

Study Setting: This was a hospital record-based study. The study encompassed all cerebrovascular accident patients originating from Uttarakhand and the western region of Uttar Pradesh throughout the year 2018.

The research was carried out at the Himalayan hospital, situated in the foothills of the Himalayas within the Dehradun district. The data utilised in this investigation, covering the period from January 2018 to May 2018,

was obtained from the Medical Record Department of Himalayan Hospital, following authorization from the Medical Superintendent. A comprehensive review was conducted on the hospital records of Cerebrovascular accident patients who were admitted to various wards and units, including the Neurology ward, ICU, General medicine ward, and other critical care-based wards and units, during the year 2018. The data pertaining to the risk variables, including age, smoking, hypertension, diabetes mellitus, alcohol intake, and dyslipidaemia, were gathered. The CT scan and MRI reports of the patient were retrieved from the hospital's medical records department.

Inclusion criteria: All patients above age 18 years having a confirmed diagnosis of cerebrovascular accident on CT scan or MRI were considered for the analysis.

Exclusion criteria:

1. Individuals under the age of 18
2. Cerebrovascular accident due to trauma.
3. Patients who did not have a Diagnosis of cerebrovascular accident confirmed by CT or MRI.

Information was sourced from medical records. “The data mining process involved two distinct phases: data preprocessing and data mining. Data preprocessing included tasks like data cleaning, integration, reduction, and transformation, while the data mining phase encompassed activities such as pattern analysis and knowledge representation”.

The collected data underwent cleansing using IBM Statistical Package for the Social Sciences (SPSS) version 22.0 for Windows. The cleansed data were weighted, and complex survey analysis was performed on them in STATA 14.1. The response rates were presented as weighted percentages and integers. Weighted results are presented in descriptive statistics as means and comparisons with 95% confidence intervals (CI). A set of administrative and clinical data were collected. Demographic information includes identifier code, first and last name, age, sex, gender, zip code, and state. Management data encompassed various aspects such as “dates of admission and discharge, source of admission (emergency department, clinic, hospital transfer), access type (emergency, scheduled, temporary), medical care provider's name, Universal Provider Identification Number (UPIN), discharge location (home, rehabilitation center, nursing home), insurance/payer information, total/reimbursement costs. Diagnostic data included information on diagnoses (free text, ICD-9-CM diagnosis codes), procedures (free text, ICD-9-CM procedure codes), disorders (free text, ICD-9-CM diagnosis codes), as well as other predictor variables and outcomes. Clinical research objectives involved tracking complications (free text, ICD-9-CM diagnosis codes), ICU days, hospital days, and patient outcomes” (e.g., survival).

Results

We collected data from the medical records of 298 patients who were admitted between January 2018 and December 2018. Age, gender, marital status, type of cerebrovascular accident, and numerous risk factors were analysed in the data. Most of the patients were from Uttarakhand and western UP.

Topographical distribution of ischemic cerebrovascular accident

108 cases of ischemic cerebrovascular accident involved large vessels, while 45 cases involved small vessels.

There were four causes of cardioembolic cerebrovascular accident, compared to 18 cases of mixed small and large vessel disease.

The salient findings of our study were as follows: -

1. Ischemic cerebrovascular accident was the most prevalent form of cerebrovascular accident.
2. Large vessel cerebrovascular accident was the most prevalent type of ischemic cerebrovascular accident, followed by small vessel cerebrovascular accident and cardioembolic cerebrovascular accident.
3. The maximum incidence of cerebrovascular accident occurred in the sixth decade, followed by the seventh.
4. The most prevalent risk factor for all categories of cerebrovascular accidents was hypertension, followed by smoking, alcohol consumption, and diabetes in that order.
5. The MCA territory was the arterial territory most implicated in ischemic cerebrovascular accidents.
6. Lesions on the left hemisphere were more prevalent than those on the right.

Table 1: Age wise distribution of different type of cerebrovascular accident in all subjects.

Age (Years)	Type of Cerebrovascular accident							
	Cardioembolic	Large vessel	Small vessel	Haemorrhagic	Venous	SAH	Mixed	Total
<40	0	11	4	5	2	3	0	25
40-50	0	16	5	20	0	3	2	46
50-60	2	29	11	30	0	3	4	79
60-70	0	22	9	24	0	3	4	62
70-80	2	18	12	20	0	2	4	58
80-90	0	10	3	4	0	1	2	20
90-100	0	2	1	3	0	0	2	8
Total	4	108	45	106	2	15	18	298

Patients were older than 18 years, with an average age of 58.6615.77 years. The occurance of cerebrovascular accident is highest in the 50–60 age group, followed by the 60–70 age group (Table 1). The percentage of patients under the age of 40 was extremely low.

Type of ischemic cerebrovascular accident: Most cases (52.68%) involved ischemic cerebrovascular accident. Haemorrhagic cerebrovascular accident made up 35.57 percent of the cases. Large artery atherosclerosis was the most prevalent cause of ischemic cerebrovascular accident (68.78% among ischemic cerebrovascular accidents), followed by small vessel cerebrovascular accident (28.66%) and cardioembolic cerebrovascular accident (2.55%). (Table 1).

Table 2: Prevalence of risk factors in ischemic (Cardioemboloic, Large vessel, smell vessel and mixed), Hemorrhagic, SAH and Venous cerebrovascular accident

Risk factors	Cardioembolic	Haemorrhagic	Large vessel	Mixed	SAH	Small vessel	Venous	Total
Female	0	37	43	6	6	15	2	109(36.6%)
Male	4	69	65	12	9	30	0	189(63.4%)
Hypertension	4	81	70	13	12	22	0	202(67.8%)
Dyslipidaemia	0	45	4	0	2	0	0	61(17.8%)
T2d (n=298)	2	22	41	6	5	10	0	86(28.9%)
Cardiac Disease(n=298)	0	50	15	5	4	5	0	79(26.5%)
Smoking Habit (n=298)	2	51	34	9	8	9	0	113(37.9%)
Alcohol intake (n=298)	2	52	28	9	8	5	0	104(34.9%)
Family history of cerebrovascular accident(n=298)	0	3	4	2	0	2	0	11(3.7%)

Gender: Most patients were male (63.4%), while females accounted for 36.6% of cases. Male to female ratio was roughly 2:1.

Hypertension accounted for 67.8% of the cases, followed by smoking (37.9%), alcohol consumption (34.9%), type 2 diabetes mellitus (28.9%), cardiovascular disease (26.5%), and dyslipidaemia (17.8%). The familial history of cerebrovascular accident was the least prevalent risk factor, accounting for only 3.7% of cases. (Table 2).**Table 3: Distribution of the cerebrovascular accident as per the arterial territory in ischemic cerebrovascular accident**

Territory	Cardioembolic	Large vessels	Mixed	Total
ACA	0	16	1	17

MCA	1	52	10	63
PCA	3	40	7	50

Table 4: Distribution of the cerebrovascular accident as per the laterality of cerebrovascular accident

LATERALITY	**Cardioembolic**	**Intracranial Haemorrhage**	**Large vessel**	**Mixed**	**Total**
RIGHT	0	41	37	2	80(33.90%)
LEFT	1	55	47	6	109(46.19%)
BILATERAL	3	20	23	10	56(23.73%)
Total	4	106	108	18	236

Most ischemic cerebrovascular accidents occurred in MCA territory (39.4%), followed by PCA territory (31.8%) and ACA territory (10.82%).43.3% of cerebrovascular accident incidences occurred on the left hemisphere, 32.2% on the right hemisphere, and 27.85% of cases were bilaterally distributed. (Table 3 and Table 4)

Discussion

Our study is a retrospective investigation conducted in the Himalayas. The focus of the study was on the demographic and risk factors that influence the different categories of cerebrovascular accidents. We discovered that the incidence of cerebrovascular accident was highest among those aged 50–60, followed by those aged 60–70. The occurance of cerebrovascular accident was higher in men compared to women (63.4% vs. 36.8%). Our findings were also corroborated by national and international studies [9, 10, 11] that favoured the distribution of cerebrovascular accidents in this age group and among men.

Hypertension stands out as the most significant risk factor for all types of cerebrovascular accident. In our country, hypertension often goes undiagnosed and is inconsistently treated. This contributes to the heightened prevalence of cerebrovascular accident and serves as a risk factor for vascular disease. Hypertension causes endothelial damage and accelerates the onset of atherosclerotic plaque formation and lipohyalinosis of the small-sized vessels. This further increases the patients' susceptibility to vascular events. [13]

Diabetes is a recognized risk factor as it accelerates the formation of atherosclerotic plaques and contributes to endothelial damage. Numerous studies have underscored diabetes as a significant risk factor for vascular events, including intracranial atherosclerotic disease. This condition affects endothelial function, systemic inflammation, and capillary basement membrane thickening. Inflammation is pivotal in the formation of atherosclerotic plaques [14]. Hence, early prevention measures, such as managing risk factors like hypertension and dyslipidemia, as well as treating diabetes, are crucial for cerebrovascular accident prevention.

The study found atherosclerotic carotid artery disease in 2 (7.14%) and 4 (8.3%) patients with large vessel disease and small vessel disease, respectively. As implied, atherosclerotic carotid artery disease is one of the

leading causes of artery-to-artery embolic cerebrovascular accidents, demonstrating that it may not only be a direct risk factor, but also be associated with intracranial atherosclerosis, which may contribute to cerebrovascular disease and its complications [15, 16]

The direct toxic impacts of substances like 1,3-butadiene and the vapor phase of environmental tobacco smoke have been associated with smoking's pathogenic mechanisms. These mechanisms include carboxy-hemoglobinemia, heightened platelet aggregation, elevated fibrinogen levels, reduced HDL-cholesterol, and hastened atherosclerosis, as observed in animal models. [17, 18]. Our study's findings were consistent with those of previous research, confirming smoking's dominance over all other risk factors for cardiovascular disease [19, 20] .

In our study, the most prevalent arterial territory involved in ischemic cerebrovascular accident was the middle cerebral artery. This is consistent with findings from previous research studies [21]. The MCA is divided into four subsections: M1, M2, M3, and M4. It supplies the frontal, temporal, and parietal cortices, and their respective subcortical regions via these branches. Furthermore, it provides blood to deeper grey matter structures like the basal ganglia and a portion of the thalami. Although we have not categorised the cerebrovascular accidents according to the subdivisions involved, most of our cases involved M1 and M2 lesions. This was followed by the territory of the PCA and the ACA. These results are comparable to those of numerous prior studies [22, 23]. Patients with MCA infarcts also exhibited concurrent ACA infarcts. This is significant because it may result in poor clinical outcomes for these patients [24]. The incidence of cerebrovascular accident occurred on the left hemisphere (46.19%), the right hemisphere (33.90%), and bilaterally in 23.73% of cases. This result corroborated with the findings of numerous previous studies [25]. We attribute this finding to our study's small sample size. Also, a significant proportion of cases in our study involved bilateral cerebrovascular accidents, which could be attributed to the occurrence of multiple cerebrovascular accidents in these patients over time. Also, right hemispheric cerebrovascular accidents are frequently overlooked, whereas left hemispheric cerebrovascular accidents are readily identifiable [26]. The presence of these silent infarcts on MRI has been attributed to the similar outcomes in numerous past studies [26, 27, 28]. Left hemisphere cerebrovascular accidents may be referred to the hospital more frequently than right hemisphere cerebrovascular accidents. This is because these patients exhibit numerous symptoms, such as focal weakness and aphasia [26, 29].

According to the topographical classification of cerebrovascular accident, most cases involved large vessels, followed by small vessels, and mixed types. Other determined aetiology or indeterminate aetiology cerebrovascular accidents were not present in our study population. This finding corroborates with previous research that attributed most cases of ischemic cerebrovascular accident to disease of the large arteries [30].

Conclusion

Ischemic cerebrovascular accident is the predominant form of cerebrovascular accident, with large vessel cerebrovascular accident being the most prevalent subtype, succeeded by small vessel cerebrovascular accident and cardioembolic cerebrovascular accident. Hypertension stands out as the primary risk factor for all cerebrovascular accident subtypes, trailed by smoking, alcohol consumption, and diabetes. Ischemic cerebrovascular accident frequently impacts the middle cerebral artery (MCA) territory, with right hemispheric cerebrovascular accidents being more common than left hemispheric cerebrovascular accidents.

Strength and limitations:

This is one of the few studies examining the clinico-epidemiological and etiological profile of Cerebrovascular

accident in Uttarakhand state.

We aim to use artificial intelligence to extend the scope of the study and develop a model for cerebrovascular accident prediction and risk factor analysis due to the less number of sample.

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