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Research Article

Clinical diagnosis of stroke patients using SIRIRAJ stroke score and Computed Tomography

Ram Narayan Mandal[1*], Ajay Kumar Mishra[1], Elena Leonidovna Mandal[2], Margarita Ramovna Mandal[3], Shambhu Sah[4], Vijay Kumar Sah[5], Rajiv Jha[6]

Author's Affiliations

[1,5]Associate Professor, Department of Internal Medicine, Janaki Medical College, Janakpur, Nepal
[2]Senior Consultant Neurologist, Cardio–neuro Center, Kadam Chowk, Janakpur, Nepal
[3]Assistant Professor, Department of Internal Medicine, Order of the Red Banner of Labour Medical Institute named after S. I. Georgievsky. Republic of Cream, Russian Federation.
[4]Assistant Professor, Department of Radiology, Janaki Medical College, Janakpur, Nepal
[6]Assistant Professor, Department of Internal Medicine, Janaki Medical College, Janakpur, Nepal

Correspondence to:
Dr. Ram Narayan Mandal
Department of Internal Medicine,
Janaki Medical College. Janakpur. Nepal
Email: elmarama1967@yahoo.com

ABSTRACT

Background & Objectives: Stroke is a significant cause of disability and death globally, with ischemic and hemorrhagic types. Rapid diagnosis is critical, particularly in resource-limited settings where access to neuroimaging is restricted. Thus, this study aimed to diagnose stroke patients using the Siriraj Stroke Score (SSS) and computed tomography at Janaki Medical College Teaching Hospital.

Materials and Methods: A total of 97 stroke patients presented within 72 hours of onset at Janaki Medical College Teaching Hospital, Nepal, were included in this study. Patients were clinically assessed using the SSS and subsequently underwent CT brain scanning to confirm the stroke subtype. The SSS was calculated based on consciousness level, headache, vomiting, atheroma markers, and diastolic blood pressure. The results from SSS were compared with the CT scan findings to determine the clinical diagnosis.

Results: The study found that 56.7% of the patients had hemorrhagic strokes, with intraparenchymal hematoma being the most common subtype. The SSS showed a strong correlation with CT scan results, particularly for hemorrhagic strokes, where most patients with a score above 1 were accurately diagnosed.

Conclusion: The Siriraj Stroke Score is a valuable tool for initial stroke assessment, especially in settings where advanced neuroimaging is not immediately available. The study supports using SSS in early stroke management, which could improve patient outcomes in resource-limited environments.

Keywords: Cerebrovascular Accident, Computed tomography, Clinical Diagnosis, Siriraj Stroke Score, Stroke

INTRODUCTION

Stroke is a neurological condition that is clinically defined as an acute, focal loss of function in the brain that is caused by vascular injury (hemorrhage, infarction) to the central nervous system [1]. It is a major cause of disability and death worldwide, characterized by a sudden interruption of blood flow to the brain. Stroke can be broadly classified into two types, ischemic and hemorrhagic. Ischemic strokes are far more common than hemorrhagic strokes [2]. Ischemic strokes account for approximately 85% of all strokes and are often caused by atherosclerosis or embolism [3]. Risk factors include hypertension, diabetes, smoking, and atrial fibrillation [4]. Rapid diagnosis and treatment are crucial in stroke management. The "time is brain" concept emphasizes the importance of quick intervention to minimize brain damage [5]. Stroke is a critical neurological event that requires rapid assessment and management.

Various stroke scoring systems play a crucial role in assessing severity, predicting outcomes, and guiding treatment decisions in stroke care. The National Institutes of Health Stroke Scale (NIHSS) is widely used to quantify neurological deficits [6], while the Glasgow Coma Scale (GCS), though not stroke-specific, assesses consciousness levels [7]. For evaluating daily living activities, the Barthel Index is commonly employed [8]. The Alberta Stroke Program Early CT Score (ASPECTS) aids in assessing early ischemic changes on CT scans [9]. Two important scoring systems used in stroke care are the ABCD2 score for transient ischemic attack (TIA) risk stratification and the Siriraj Stroke Score for differentiating between ischemic and hemorrhagic strokes. The ABCD2 score is a clinical prediction rule used to determine the risk of stroke following a TIA. It was developed to help identify high-risk patients who may need urgent evaluation and treatment [10]. The Siriraj Stroke Score is a clinical scoring system developed to differentiate between ischemic and hemorrhagic strokes in settings where neuroimaging may not be immediately available [11]. The score is calculated based on [Consciousness level; Vomiting; Headache; Atheroma markers (diabetes, angina, intermittent claudication), and Diastolic blood pressure]. A score >1 suggests hemorrhagic stroke, while a score <-1 suggests ischemic stroke. Scores between -1 and 1 are considered equivocal. The Siriraj Stroke Score, while useful as a quick bedside test, is not as accurate as neuroimaging in differentiating stroke types. Modern stroke management guidelines emphasize the importance of rapid neuroimaging (CT or MRI) for definitive diagnosis and treatment planning [12]. Brain computed tomography (CT) scans have become the most widely utilized primary radiologic examination in clinical practice [13] A head CT scan can immediately show the location and size of brain anomalies like blood clots or tumors. It also can reveal infections or areas of the brain tissue that are withering or dead. A CT scan can determine if a stroke is ischemic or hemorrhagic. In stroke CT scan helps to detect blood in the skull from a hemorrhage, ensuring proper treatment [14]. The scoring systems and CT scans can be valuable for initial assessment and triage, particularly in settings where advanced imaging is not immediately available. Also, the cost of neuroimaging plays a role in patients with low socioeconomic status to fully diagnose stroke. Thus, this study aimed to compare the clinical diagnosis with the Siriraj Score and CT scan in the determination of stroke among the patients visiting Janaki Medical College teaching hospital.

MATERIALS AND METHODS

A total of 100 consecutive new stroke patients presented in the Emergency Department of Janaki Medical College Teaching Hospital, Ramdaiya Janakpur Dham, Nepal within 72 hours of onset of illness during the period of 16th June 2019 to 14th June 2020 were enrolled. All the patients taken were admitted into the Medical Ward of Janaki Medical College Teaching Hospital, Janakpur which is a tertiary-level referral center situated outside of Kathmandu located in Kshireshwornath municipality, Dhanusha in Madhesh province, Nepal. IRC of Janaki medical college provided the ethical approval (Ref: IRC/12/2075-076). All the clinically suspected cases of stroke presented within 72 hours of the onset of illness were subjected to the following steps in the Emergency Ward: (detailed history, through clinical examination and needed investigation with special too and calculating of "Siriraj Stroke Score (SSS)" for each patient to categorize them into one of the 3 groups depending on the resultant score) Grouping was done as a group of hemorrhagic strokes ('SSS' >1), equivocal group ('SSS' between 1 & -1) and group of cerebral infarctions ('SSS' <1). Afterward, computerized brain scanning of all irrespective of the stroke subtype shown by the Siriraj stroke score was done and at the end, patients were admitted to the medical ward for further follow-up and other investigations. Patients were registered as a case of stroke only when they fulfilled the WHO criteria i.e. the current World Health Organization definition of stroke (introduced in 1970 and still used) is “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin [15].” CT scan of the head showing evidence of stroke-like cerebral infarction, cerebral hemorrhage, and subarachnoid hemorrhage were taken into account. For our purpose of comparing the efficacy of Siriraj stroke score with CT scan diagnosis, stroke cases were divided into two groups; ischemic infarction (non-hemorrhagic stroke) and hemorrhagic stroke which includes intracerebral, intraventricular & subarachnoid bleeding. To calculate Siriraj stroke score [11], for each patient, following points were taken into consideration. a. **Level of consciousness:** (Alert: - normal level of consciousness - '0' points given; Drowsy, stupor: '1' point given; Semi coma, coma: '2' points given for such group of patients), b. **Headache: -** '1' point was given and '0' point for those without headache, **Vomiting:** '1' point given and those without vomiting got '0' points, c. **Atheroma markers:** 3 main points for atheroma markers were taken. Diabetes mellitus, Angina or ischemic heart disease, and Intermittent Claudication of limbs. If yes given '1' point and no given ‘0’ point and d. **Blood pressure.** Finally, Siriraj stroke score was calculated for each patient as shown below before the patient was sent for CT brain scanning.

Siriraj Stroke Score = ((2.5 × consciousness) + (2 × vomiting) + (2 × headache) + (0.1 × diastolic blood pressure) - (3 × atheroma) - 12.

Among 100 consecutive patients included in this study, 3 of them had to be dropped because one of them couldn't afford CT brain scanning for comparison with her clinical diagnosis of stroke subtype and two of the excluded subjects had no proper history suitable enough for the clinical scoring to carry out. Data were processed and tabulated by using computer software developed by WHO which is EPI-INFO-6.

RESULTS

Our study included 97 stroke patients, with the majority (n=58, 59.8%) being aged 60 years and above (Table-1). Majority (64%) of the patients were male (Figure 1). Majority of the patient (n=55, 56.7%) suffered from hemorrhagic stroke and within sub category of hemorrhagic stroke, intraparenchymal hematoma (IPH) was the most common subtype, occurring in (n=37, 38.1%) of the total patients (Table-2). Age-wise distribution of stroke subtypes indicated that ischemic stroke (n=25) was more common in age 60 and above (Table-3). The Siriraj stroke score correlated strongly with CT scan results, particularly for hemorrhagic strokes, where most patients with a score above 1 (n=50) were accurately diagnosed with hemorrhagic stroke (Table-4).

Table-1: Age distribution of Stroke Patients

Age-group (in years)	Frequency (n)	Percentage (%)
20-39	6	6.2
40-59	33	34.0
60 and above	58	59.8
Total	**97**	**100.00**

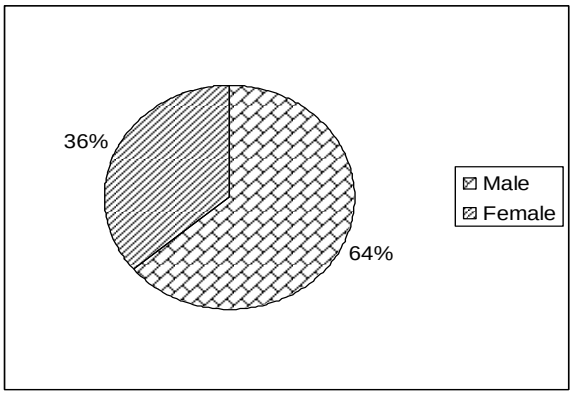

Figure-1: Sex distribution of Stroke Patients

Table-2: Distribution of stroke patients according to stroke subtypes

Subtypes of stroke	N	(%)
Ischemic stroke	42	43.3
Hemorrhagic stroke	55	56.7
Intraparenchymal hematoma	37	38.1
Intraparenchymal hematoma with intraventricular spillage	12	12.4
Intraparenchymal hematoma with intraventricular spillage & subarachnoid hemorrhage	6	6.2
Total	**97**	**100**

Table-3: Cross tabulation of stroke subtypes and age distribution

Age (years)	Different stroke subtypes				
	IS	IPH	IPIV	IPIVSAH	Total
20-39	3	3	0	0	6
40-59	14	11	6	2	33
60 and above	25	33	6	4	58
Total	42	34	12	6	97

(**IS**-Ischemic stroke; **IPH**-Intraparenchymal hematoma; **IPIV**-Intraparenchymal hematoma with intraventricular (IV) spillage; **IPIVSAH**-Intraparenchymal hematoma with IV spillage & SAH)

Table-4: Cross tabulation of Siriraj stroke score & CT scan diagnosis

Siriraj stroke score	CT scan diagnosis	
	Hemorrhagic stroke (n=55)	Ischemic stroke (n=42)
Above 1	50	2
-1,1	3	0
Below -1	2	40

DISCUSSION

Age plays a crucial role in stroke incidence, treatment, and outcomes. Published literature demonstrates that younger stroke patients,

particularly those aged 18-44, are less likely to utilize healthcare services before a stroke compared to older individuals aged 45-65 [16]. This study included 97 stroke patients where most of them were in the age of 60 years of age or older which is consistent with The Framingham Heart Study's findings that the risk of stroke doubles every ten years after the age of 55 [17] which is suggestive of the known association between aging and an increased risk of stroke. The possibility is due to the cumulative effects of vascular aging, such as arterial stiffening and endothelial dysfunction which provides the physiological basis for this trend [18].

In our study, the male preponderance is consistent with worldwide patterns. Males have a 24% higher lifetime risk of stroke than females, according to the American Heart Association [19]. There are several potential explanations for this gender gap, such as variations in vascular biology, hormonal effects, and lifestyle choices like drinking alcohol and smoking, which are generally more common in men [20].

Our study revealed that hemorrhagic stroke was more common than ischemic stroke, with intraparenchymal hematoma (IPH) being the most common subtype. This is in stark contrast to data from around the world, which show that 87% of cases are usually caused by ischemic strokes [19]. This might be due to underlying diseases of patients like uncontrolled hypertension or genetic predisposition to intracranial aneurysms which are the associated risk factors for hemorrhagic stroke [21]. Other probable causes may be related to environmental factors such as dietary habits like high salt intake, or environmental exposures could contribute to this pattern [22].

The age distribution indicating a higher frequency of ischemic stroke in patients 60 years of age and older is consistent with the findings of the Cardiovascular Health Study, which showed that the incidence of ischemic stroke rises sharply with age, primarily as a result of the increased prevalence of large artery atherosclerosis and atrial fibrillation in this age group [23].

The positive link between the Siriraj stroke score and CT scan results, particularly for hemorrhagic strokes was noted. Our findings are more in line with research carried out in environments with limited resources, like the Tanzanian study by Mwita et al. (2014), which discovered that the Siriraj score was an effective method for identifying distinct forms of stroke [24]. The high accuracy for hemorrhagic stroke in our study (most patients with a score above 1) suggests that the score might be particularly sensitive to clinical features of hemorrhagic stroke in our population.

While the Siriraj score showed good performance in our study, its accuracy can vary widely. A systematic review demonstrated that sensitivities of Sriraj Stroke Score ranging from 61% to 98% for hemorrhagic stroke across different studies [25]. The higher occurrence of hemorrhagic strokes, particularly IPH, in our study population has important clinical and public health implications which suggests a need for targeted interventions focusing on risk factors specific to hemorrhagic stroke. For instance, blood pressure management might be particularly crucial in this population, as hypertension is the strongest risk factor for IPH [26]. Also, careful monitoring and management of anticoagulation therapy in at-risk patients could help prevent hemorrhagic complications [27]. Siriraj stroke score is a very useful clinical tool for diagnosing stroke subtypes, especially in a country like Nepal where modern imaging techniques is not readily available for the majority of the population. However more extensive, larger

studies may be anticipated before generalizing the findings of this study.

CONCLUSION

The use of the Siriraj Stroke Score and CT scan could enhance early stroke management and possibly reduce mortality and morbidity. SSS and CT-scan can be a crucial tool in the treatment of acute strokes, particularly in areas like Janakpurdham where access to neuroimaging services is restricted. Future studies should focus on refining the score and exploring its applicability in other populations, especially in rural and resource-limited settings within Nepal.

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