Original Article

CORRELATION OF SEVERITY OF ISCHEMIC STROKE WITH BODY TEMPERATURE

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Objective: To correlate severity of National Institute of Health Stroke Scale (NIHSS) score with body temperature.

Methods: A descriptive and cross-sectional study was conducted in General Hospital, Lahore. This study is conducted from 1st July 2014 to 30th December 2014. 220 patients with diagnosed ischemic stroke were included in the study after informed consent. Rectal temperature of all patients was measured and recorded with rectal thermometer. NIHSS scoring was done at presentation. Pearson correlation coefficient was determined for correlation between rectal temperature and severity of stroke using SPSS 17.

Results: 220 patients with mean age of 55 ± 3.424 years were included. Age ranged from 39 to 60 years. 141 (64.1%) were male patients and 79 (35.9%) were females. Body temperature ranged from 95-1020F while mean temperature was 98.18 ± 2.014 of NIHSS Score of sampled population was 14 to 30 with mean score 23.90 ± 4.139. There was a statistically significant correlation between body temperature and severity of stroke ($p < 0.001$, correlation coefficient r=-0.528)

Conclusions: Body temperature as determined by rectal thermometer at time of presentation with stroke is moderately correlated with stroke severity as measured by NIHSS (r=-0.528)

Keywords: Stroke, Hypothermia, Rectal temperature, Ischemic stroke, NIHSS score

Introduction

Stroke is a clinical syndrome characterized by rapidly developing symptoms and/or signs of focal and at times global (for patients in coma) loss of cerebral functions, with symptoms lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin. According to World Health Organization report 2002, total mortality due to stroke in Pakistan was 78512. By 2020, stroke mortality will have almost doubled.[1] Increased body temperature markedly exacerbates neuronal injury in experimental models of cerebral ischemia. An association between increased body temperature and poor outcome has been shown in patients with acute stroke. However, the temporal profile of this relation is not well established. Several prospective studies found that high body temperature on admission was associated with poor outcome. Others found that an increased body temperature within the first days after stroke onset was a prognostic factor for unfavorable outcome.[2] Body temperature is an important topic in ischemic stroke. As hypothermia is considered a robust neuro protectant and has shown efficiency against a variety

of brain injuries at an experimental level, the influence of body temperature and hypothermia on ischemic stroke is of great interest.[3] A recent study showed that low body temperature on admission was associated with persistent proximal middle cerebral artery occlusion. These results may support a possible detrimental effect of low body temperature on clot lysis and recanalization. Admission body temperature, 36.5°C was independently associated with persistent middle cerebral artery occlusion when adjusted for confounders in multivariate analyses (odds ratio 3.7, P = 0.007).[4] A study suggests that low body temperature within 6 hours of symptom onset is associated with severe ischemic stroke. Linear regression showed that low body temperature on admission was independently associated with a high NIHSS (National Institute of Health Stroke Scale) score within 6 hours of stroke onset in patients with ischemic stroke The correlation between NIHSS score and body temperature on admission was r = −0.17 (P<0.001).[5] A pilot study done on 30 patients of ischemic strokes with rectal temperature less than 97.8 of presenting in emergency of Lahore general hospital, Lahore, found that 18 (60%) had severe stroke with mean NIHSS score 30, 6 (20%) had moderate to severe stroke with mean NIHSS score 18, 4 (13%) had moderate stroke with mean NIHSS score 10.This study was planned to determine correlation between severity of ischemic stroke and body temperature in patients on admission in tertiary care hospital. This may help to provide new 0 bservational data to become clearer that

Hypothermia Also cause poor ischemic stroke outcome as does hyperthermia thus stressing on keeping the ischemic stroke patients euthermic.

Methods

This descriptive cross sectional study was conducted in Department of Medicine, PGMI/Lahore General Hospital, Lahore, during a period of six months from 1st July 2014 to 30th December 2014 in Ameer-Uddin Medical Collage. The calculated sample size was 220 cases with 5 % type I error and 10 % type 2 error taking an expected correlation as 0.175 between NIHSS score and body temperature. Non probability consecutive sampling technique was used for recruiting patients.

All patients of either gender, age ≥ 30years diagnosed as ischemic stroke i.e. patients presenting with focal neurological deficit (weakening of any part of the body) for more than 24 hours in whom CT scan brain showed a hypodense area corresponding to the clinical picture were considered eligible for the study [7]. Exclusion criteria were patients developing stroke due to other reasons like tumors, meningitis, vasculitis; patients with history of intervention or surgery i.e. end arterectomy or patients who received any antipyretic, water sponging or intravenous fluids before temperature recording.

Two hundred and twenty cases fulfilling inclusion and exclusion criteria were included in study. Informed consent was taken from patient or first degree relative. Demographic history including age and sex was taken. CT scan brain was done to diagnose ischemic stroke. Rectal temperature of all patients was measured and recorded with rectal thermometer. The National Institute of Health Stroke Scale (NIHSS) was used to assess stroke severity on admission. National Institute of Health Stroke Scale (NIHSS) scoring was done (Table I), [8]. The NIHSS is both reliable and valid, and has become a standard stroke impairment scale for use in both clinical trials and as part of clinical care in the United States.Data were entered and analyzed on SPSS version 21.0 software program. The qualitative variables like gender (male or female), body temperature (low, normal or high) and severity of ischemic stroke (no stroke symptoms, minor stroke, moderate stroke, moderate to severe stroke, severe stroke) were presented as frequency and percentages. Quantitative data like age (in years), NIHSS score and body temperature were presented as mean and standard deviation. Pearson's correlation test was applied to determine the correlation between severity of ischemic stroke and body temperature. Mean age was compared using independent sample t test while post stratification chi square test was used. P value ≤ 0.05 was taken as significant.

Results:

220 diagnosed patients of ischemic stroke, with mean age 55 ± 3.424 years and age ranging from 39 to 60 years were included in the study. Out of 220 patients, 141(64.1%) were male patients with ischemic stroke and 79(35.9%) were females. Body temperature of sampled population in Fahrenheit ranged from 95-102°F while mean temperature was 98.18 ± 2.014. NIHSS Score of sampled population was 14 to 30 with mean score 23.90 ± 4.139 standard deviation (**Table II).Figure1** shows the relationship between body temperature on admission within 6 hours of stroke onset in patients with ischemic stroke and their corresponding NIHSS scores.When we correlated the body temperature with NIHSS stroke severity score, Pearson correlation was significant at given sample size and value of r came out -0.528 **(Table II).**

Table-1: National institute of health stroke scale.[8]

Item		Score
1.a. Level of consciousness	Alert	0
	Drowsy	1
	Stupprous	2
	Coma	3
1.b. LOC questions	Answers both correctly	0
	Answers one correctly	1
	Incorrect	2
2. Pupillary reponse	Both Reactive	0
	One reactive	1
	Neither reactive	2
3.Best gaze	Normal	0
	Partial gaze palsy	1
	Forced deviation	2
4. Best visual	No visual loss	0
	Partial hemianopia	1
	Complete Hemianopia	2
5. Facial palsy	Normal	0

	Minor	1
	Partial	2
	Complete	3
6. Best motor arm	No drift	0
	Drift	1
	Can't resist gravity	2
	No effort against gravity	3
7. Best motor leg	No drift	0
	Drift	1
	Can't resist gravity	2
	No effort against gravity	3
8. Plantar Reflex	Normal	0
	Equivocal	1
	Extensor	2
	Bilateral extensor	3
9. Limb ataxia	Absent	0
	Present in upper or lower	1
	Present in both	2
10. Sensory	Normal	0
	Partial Loss	1
	Dense Loss	2
11. Neglect	No neglect	0
	Partial Neglect	1
	Complete neglect	2
12. Dysarthria	Normal artculation	0
	Mild to moderate dysarthria	1
	Near unintelligible or wrose	2
13. Best Language	No aphasia	0
	Mild to moderate aphasia	1
	Severe aphasia	2
	Mute	3
14. Change from previous exam	Same	S
	Better	B
	Worse	W
15. Change from basline	Same	S
	Better	B
	Worse	W

Table-2: Temperature and NIHSS score distribution of sampled population (n=220).

	Minimum	Maximumo	Mean	
Body Temperature (F)	95	102	98.18	2.014
NIHSS Score	14	30	23.90	4.139

NIHSS=National institute of Health stroke scale

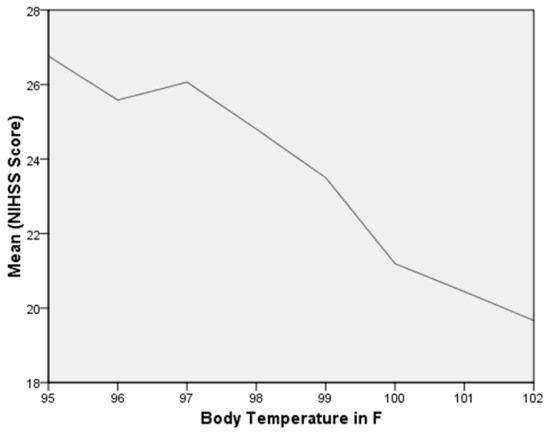

Figure I: Correlation between body temperature and NIHSS stroke severity score

Discussion:

Increased body temperature markedly exacerbates neuronal injury in experimental models of cerebral ischemia. An association between increased body temperature and poor outcome has also been shown in patients with acute stroke.As hypothermia is considered a robust neuroprotectant and has shown efficiency against a variety of brain injuries at an experimental level, the influence of body temperature and hypothermia is of great interest.[3] In the present study, mean age of presentation was 55 ± 3.424 years ranging from 39 to 60 years showing involvement of cerebral arteries at an earlier age quite different from age in western countries. More preventive measures need to be taken to reduce the incidence of stroke in our population which is currently suffering double burden of disease i.e. both infectious and noninfectious. Out of 220 patients, 141(64.1%) were

male patients with ischemic stroke while only 79 (35.9%) were females showing estrogen protection even after menopause. Mean body temperature of sampled population was 98.18 ± 2.014ºF. NIHSS score of sampled population was 14 to 30 with mean score 23.90 ± 4.139.Correlation of the body temperature with NIHSS stroke severity score, showed significant Pearson correlation coefficient (r=-0.528) at given sample size (n=220), (P<0.05). These results emphasize on the maintenance of body temperature immediately after stroke. Acute exonal injury leads to disturbed body temperature regulations or vice versa. Patients with stroke need proper ambient temperature so we may reduce the subsequent morbidity.

These results are supported by similar local and international studies. A pilot study done on 30 patients of ischemic strokes with rectal temperature <97.8°F presenting in emergency of Lahore General Hospital, Lahore had found that 18 (60%) suffered severe stroke with mean NIHSS score 30, 6 (20%) suffered moderate stroke with mean NIHSS score 18, 4 (13%) had mild stroke with mean NIHSS score 10. Blanco *et al.*[9] prospectively studied 2931 consecutive patients, 2468 with ischemic stroke and 463 with intracerebral hemorrhage, and recorded temperature at admission and then at 24, 48 and 72 hours after admission.

Temperature in stroke patients was found higher than in controls, and increased gradually in the first 72 hours after stroke. A positive correlation between temperature and stroke severity determined by NIHSS was found at 24 and 48 hours. A high temperature was associated with poor outcome at 24 hours (OR 2.05, 95% CI 1.59-2.64, p<0.0001) and 48 hours (OR 1.93, 95% CI 1.08-2.34, p=0.007), but not at admission or 72 hours.

They concluded that temperature increased in stroke patients in the first 72 hours, with the deleterious effect of high temperature occurring in the first 48 hours and the neuroprotective effect of low temperature occurred within the first 24 hours from stroke onset.Similarly, Millán*et al.*[10] studied 254 patients treated with intravenous tissue plasminogen activator (tPA) within 3 hours of stroke onset and recorded NIHSS score, body temperature, and transcranial Doppler ultrasound (n = 99) on admission and at 24 hours.

They found that body temperature ≥37ºC at 24 hours, but not at baseline, was associated with a lack of recanalization, greater hypodensity volume and worse outcome in stroke patients treated with tPA. Boysen and Christensen[11] measured body temperature on admission and every 2 hours during the first 24 hours in 725patients of acute stroke.

They showed thatat 8 hours after stroke onset, higher body temperature was a negative predictor of outcome 3 months after stroke.Similar results have been reported by Reith *et al.*[12], Castillo *et al.*[13] and Jorgensen*et al.*[14] However, our results differ from certain other studies. Kvistad*et al.*[5] measured body temperature in 516 patients of ischemic stroke within 6 hours of onset of symptoms.

They concluded that low body temperature on admission was independently associated with a high NIHSS score within 6 hours of stroke onset in patients with ischemic stroke (P<0.001). They speculated that cold temperature prolongs coagulation time and worsens the clot formation, thus exacerbating the neurological deficit.

The discrepancy between the study by Kavistad*et al.*[5] and others can be explained due to different study design. Kavistad*et al.*[5] measured body temperature within 6 hours of onset of symptoms of ischemic stroke whereas most other researchers recruited patients of ischemic stroke after 6 hours of start of symptoms. Limitations of current study include ecological fallacy, small sample size and non-adherence to more robust study designs.

Conclusion

It is concluded that body temperature as determined by rectal thermometer at time of presentation with stroke is moderately correlated with stroke severity as measured by NIHSS (r=-0.528).

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CORRIGENDUM

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