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Study of Epidemiological Determinants of Patients Presented with "Heat Wave Related Illness" Admitted in Tertiary Care Center

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ABSTRACT

Context: Heat related illnesses (HRI) though preventable are increasing worldwide. People living in developing countries like India are at greater risk. The study was conducted to find out epidemiological determinants of patients admitted with Heat related illness and to study prognostic variables and factors affecting mortality

Methods: This is a prospective study of adult patients admitted at our institute with HRI during months of May and June. (average max. temp. > 40 degree Celsius). Sociodemographic profile, working environment information, co- morbid conditions, clinical aspects and bio chemical parameters were studied.

Results: Relatively young male patients working outdoor without personal protective measures for long duration were affected the most. Significantly low level of education and lack of personal protective measures were important contributors. Giddiness was most common symptom followed by Fever and Headache. Hypotension, tachycardia and low GCS score were associated with HRI mortality. Hypertension, Diabetes and past CV Stroke were most common associated co morbidities.

Conclusions: HRI are at rising trend, especially in developing countries. More aggressive and multifactorial approaches are required for public awareness. Mandatory use of protective measures at workplace and timely hospitalization is the key to prevent HRI and its mortality.

Key-words: Heat stroke, Heat exhaustion, HRI mortality.

INTRODUCTION

Heat wave related illness and deaths are increasing in developing countries like India mainly due to climate change.[1] The spectrum of Heat related illness ranges in severity from mild, common heat cramps and heat rash to potentially fatal heat stroke.[2,3]

Heat exhaustion is body's response to excessive loss of water and salt through sweating. Symptoms include heavy sweating, extreme weakness, dizziness, muscle cramps, hyperventilation and slightly increased body temperature [2,3,4]. No alteration in mental status is an important distinguishing factor between heat exhaustion and heat stroke. However, there are often blurred boundaries between the two. Heat stroke requires both a core body temperature greater than 40 C and central nervous system dysfunction that results in delirium, convulsions and coma. This is the final result of impaired heat load dissipation.

Heat stroke can be divided into two main types: classic (non-exertional) and exertional heat stroke [2,3,4] A typical patient with classic heat stroke may be poor, elderly patient with multiple comorbidi-

ties and on medicines, found confused or unresponsive during period of Heat wave. In contrast, a victim of Exertional Heat Stroke would be young military recruit exercised to the point of collapse on a hot sunny day.

Ahmedabad had a major heat wave in May 2010, which led to 1344 additional deaths registered in the city during the month of May.[4] Highest temperature in the history of Ahmedabad city was recorded on May 18 and 19, 2016 which was 50 degree centigrade. Climate change is expected to bring increasingly frequent and severe extreme heat events to the region. Infants and children, elderly people, outdoor workers, athletes and people with chronic medical conditions are at higher risk. [5,6,14] people living in urban area may be at greater risk especially slum dwellers [4,8,9]

Detailed study of socio-demographic profile, knowledge and attitude and clinical aspect of patients suffering from heat related illness can help to make better heat action plan and save lives. The main objective of this study is to identify people at risk of HRI and study the factors affecting outcome in hospitalized patients.

SUBJECTS AND METHODS

This is an observational prospective study carried out for two months duration [May and June 2017] after IRB approval. All the patients above 18 years of age, admitted to V.S. Hospital, Medicine Department, with clinical diagnosis of heat related illness are included after obtaining written I consent form in vernacular language. Detailed clinical history and Demographic profile were collected in proforma on admission. Examination finding and lab investigations reports were recorded. These patients were followed up daily until discharge. Course of the illness, any adverse events, Discharge or Death were recorded.

Inclusion criteria [2,3,4,10]: All patients admitted with history of acute onset giddiness, fever, headache, vomiting or altered sensorium, with clinical diagnosis of Heat Exhaustion or Heat Stroke were included. CPK could not be done in few patients due to financial constraint.

Exclusion criteria: Patients with CNS infection, stroke, metabolic encephalopathy, or any other intracranial pathology were excluded.

Detailed clinical examination was done on admission and daily during hospital stay and progress was monitored. Detailed CNS evaluation was done daily using Glasgow coma scale (GCS) score. Outcome data on mortality, duration of hospitalization and discharge GCS score were noted.

Data analysis was done using SPSS software version 20. Values for continuous data were expressed as mean +/- standard deviation (SD). Categorical variables were reported as proportions. P value was calculated to determine statistical significance. If p value is </= 0.05, difference is considered statistically significant.

This study is for academic and research purposes only.

RESULTS

Age group of patients ranges from 20 to 85 years. Predominately male patients were affected. Only 2 out of 84(2.78%) were female (table 2).

Table 1: Demographical Profile of patients admitted with HRI

Characteristics	Patients (n=84) (%)
Address	
Ahmedabad	72 (85.71)
Outside	12 (14.29)
Gender	
Male	82 (97.62)
Female	2 (2.38)
House	
Yes	82 (97.62)
No	2 (2.38)
Type of House	
Kutcha	30 (35.71)
Pucca	52 (61.9)
Outdoor work	
Yes	62 (73.81)
No	22 (26.19)
Duration Outdoor work	6.63±2.95*
Direct sun exposure (hrs.)	4.32±1.76*
Incubation Period	4.19±4.37*
Water Intake	3.35±1.67*
Co-Morbidities	
Hypertension	16 (19.05)
Diabetes	10 (11.9)
Stroke	9 (9.33)
CAD	2 (2.38)
COPD	4 (4.76)
Psychiatric illness	4 (4.76)
Parkinson	2 (2.38)
Drug History	
Statin	16 (19.05)
Diuretics	4 (4.76)
Beta Blockers	8 (9.52)
TCA	4 (4.76)
Atypical Antipsychotic	2 (2.38)
Antihistaminic	2 (2.38)
Addiction	
Smoking	39 (32.76)
Alcohol	12 (14.29)
Tobacco Chewing	24 (28.57)

* Mean ± SD

Out of 84, 36 patients (42.8 %) had Heat Exhaustion and 48 patients (57.1%) had Heat Stroke. Total 12 (14.2%) patients died due to Heat Stroke. 62 out of 84(73.8%) had exertional HRI and 22(26.1%) had non-exertional HRI.

14 out of 84 (16.66%) had no formal education, 6 (76.19%) had formal education up to higher secondary school.

57.1% (48 n) patients were admitted in the month of May while 42.8% (36 n) were admitted in June. Highest admission was in the 1st week of June.

30 (35.7%) patients were living in Kuccha house without proper ventilation facility and one patient was living on street. Only one patient had some form of cooling device available, apart from fan.

62 out of 84(73.8%) had history of outdoor work, out of which 54(64.28%) were manual worker and 8(9.5%) had work requiring prolonged standing.

Average duration of outdoor work was 6.63hr (+/- 2.95) with 4.32 (+/-1.76) hours directly exposed to sun. Average time from heat exposure to beginning of symptoms was 2 hours with minimum delay 30 min and maximum 24 hours. Average time from onset of symptoms to hospitalization was 1 hour. Average daily water intake was 3.36 liter (+/-1.68 SD).

Giddiness was most common presenting complain 66/84 (78.57%), followed by Fever, 60/84 (71.42%), Vomiting 51/84 (60.71%) and Altered mental status 50/84(59.52%). Highest temperature recorded was 107degree F.

Tachycardia and Hypotension were associated with HRI mortality with P value of < 0.05 Mean GCS on admission was 11.28 (+/- 3.81) amongst survivors and 7.17 (+/-3.13) in expired patients. 34 out of 84 (40.47%) had normal consciousness, 32(38.09 %) were drowsy, 14(16.66%) superius and 4 (4.76%) patients were comatose on admission.

Mean total CPK value was1499.56 +/- 1945.30 excluding one result of 30591 u/l. Mean CPK value in non-survivors was 1433.16 +/- 2499.08. P value of CPK was 0.94 suggesting no significant association with mortality.

Table: 2 Clinical and bio chemical parameters

Parameter	Expired		Discharged		P Value
	Mean	SD	Mean	SD	
Age	44.67	24.98	52.00	14.30	0.332
Window period	1.83	0.75	4.58	4.61	0.640
Pulse	113.00	10.86	99.81	18.60	0.017
Sap	94.00	39.29	121.83	28.16	0.010
Respiratory	24.33	2.94	21.53	4.31	0.081
Gas	7.17	3.13	11.28	3.81	0.016
Ribs	136.83	64.44	135.85	72.82	0.541
Hb	12.77	3.15	12.03	4.41	0.847
Total Count	12436.67	3647.25	9498.58	6770.38	0.088
Platelet	2.19	0.78	1.91	1.10	0.408
Urea	38.67	29.57	30.97	26.99	0.449
Creatinin	1.34	1.10	1.38	1.31	0.986
S.Na+	131.6	6.8	131.15	10.47	0.928
S.K+	3.73	1.95	3.59	1.25	0.369
S.Billirubin: Total	1.43	1.15	0.91	0.82	0.250
SGPT	51.83	66.18	40.97	70.80	0.586
Alkaline Phosphatase	88.67	84.71	66.44	52.00	0.713
CPK Total	1433.17	2499.08	2603.24	6128.35	0.981
ABGA: Ph	7.36	0.10	7.34	0.07	0.494
ABGA: Hco3	12.50	4.32	17.54	4.98	0.033

DISCUSSION

As compared to study by Kalaiselvan et al [11], our study showed that contemporary presentation of HRI is in quite younger age. Mean age of presentation in our study was 50.95(+/-16.04 SD) as compared to study of Kalaiselvan, et al[11] (53.11+/-20.59 SD) and Misset et al[15] (67.2+/-14.1 SD). This young age representation of study group can be explained by social occupational practice with younger person joining this specific type of work and likely with lack of risk perception related to Heat exposure .Striking male preponderance seen in our study 82/84 also represents the similar social occupational practice with male persons predominantly involved in manual labor work with exposure to Heat. Sex related predisposition to HRI is not studied and needs further work.

We found education of patient as significant factor found in patients presenting with HRI. Significantly low level of education was present in our patients with only 1 patient (2.3%) having education beyond higher secondary school, while 16.9 %

were illiterate. Literacy definitely affect the understanding and implication of preventive measures on patient's part. Schmeltz et al [12] and Tran KV et al[16], also noticed patients who lived in zip codes with lowest median income quartile was more likely to be hospitalized for HRI.

Another significant predisposing factor found was unavailability of cooling device at home and lack of preventive measures at workplace. Average duration of outdoor work was 6.8 hrs. which is significantly high including time directly exposed to sun, 4.32hr. Changing the Working hours from peak sun exposure to night time was never considered. A Related study by Ales Urban at el[18] and Tran Kalasha GS at el[17] noted that socioeconomic status, demographics and duration as well as intensity of heat stress period can substantially influence the overall impact. Mortality, 14.2%, was low in our study as compared to previously reported mortality of 20-62% [11] and it likely represents adequate treatment measures and increasing awareness about the illness with early presentation.

No significant differences in CPK values (p value) were observed between survivors and non – survivors of HRI. Mean CPK value was 2376.77 (+/- 5595.2 SD) amongst expired patients and 2603.24 (+/-6128.35 SD). According to Maximo et al[13], CPK >1000 U/L up to max 3,00,000 – 4,00,000 U/L indicates Rhabdomyolysis while CPK >5000 indicates severe muscle damage and > 16,000 U/L correlates with Acute Kidney Injury. In our study, only 3 out of 42 had CPK value more than 5000.Mean Sodium value in survivors was 131.15 (+/- 10.47 SD) and in expired was 131.61 (+/- 6.8 SD). According to Malaysian et al[11] mean Sodium value was 119(+/- 11.3 SD) amongst non – survivors.

CONCLUSION

Hypotension on admission, tachycardia, low GCS score, high Total Leucocyte count, and low Bicarbonate level on Blood gas analysis were the factors associated with HRI mortality. Variables not associated with HRI mortality were Age, blood Urea, S. create, S. Sodium, liver enzymes, CPK values, platelet counts and blood sugar level.

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