Original Article

Creatine phosphokinase (CPK) can be a potential diagnostic tool in heat stroke

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Objective: To highlight the degree of importance of using this test in heat stroke as diagnostic tool and its role in assessing worsening prognosis with rising CPK level or otherwise.

Methodology: Total of 78 patients admitted in Department of Medicine, JPMC, Karachi, Pakistan during 3 days from June 21st to 23rd 2015 when heat wave struck Karachi were included in the study. The patient who survived 1st hour after receiving intense ICU management underwent this laboratory test.

Result: Out of 78 patients, 51 (65.3%) were male and 27 (34.6%) female. The mortality rate was 53.8% (n=42); 33 (78.8%) were above 50 years and 9(33.3%) below 50 years. 55(70.5%) patients who survived 1st hour, were found to have raised CPK which was associated with 36.3% (n=20) mortality in patient with CPK >1000.

Conclusion: CPK, despite being non specific can be a valuable tool for diagnosis and assessing the prognosis of heat stroke patients. (Rawal Med J 201;43:29-31).

Keywords: Creatinine phosphokinase, heat stroke, Karachi.

INTRODUCTION

Heat stroke is a combination of hyperpyrexia (rectal temperature greater than 41.1 °C), anhidrosis and altered mentation.[1] It also has remarkable impact on valuable services of systems like water supply, power supply, health and other community services. These facilities generally clogged when heat wave struck some area, especially urban area.[2] Urban areas are more vulnerable to heat stroke, due to development of variety of unnatural and artificial changes in a city like various machineries (Urban Heat Island).[3,4] In modern times, there is also emerging threat of global warming.[5] The phenomenal of heat wave is in itself is unpredictable in occurrence, intensity and duration and sufficient to cause havoc independently.[6]

Increasing body temperature to and above 40°C is associated with major organs injuries. The initial symptoms include nausea, vomiting, flushed skin, tachypnea, bradycardia and headache. Later on patient suffers high grade fever, fail to sweat and developed altered mental status, abnormal behavior, seizures or coma.[7] Traditionally, heat stroke is divided in to Classical heat stroke and Exertional heat stroke. Formal is more common in elderly and in children and later is common in younger population associated with unaccustomed exercise and work in very hot weather.[8] Patients cools themselves with different methods including ice application or ice water or ice sheet is the initial treatment.[9]

The test not usually considered in heat stroke is CPK, which is though a nonspecific, although same degree of raised CPK levels may have prognostic implications.[10,11] In heat stroke, muscle damage is indicated by raised CPK, if it is more than 5 times it indicate rhabdomyolyses, which if more than 5000-10000 will indicate acute renal injury along with heat stroke and its resuscitation effort.[12]

CPK can also guide in treatment, as 1-2 litre of Normal Saline should be infused if CPK is found raised and additional I/V fluid should be infused to maintain output 2 ml/ng/hours. CPK reaches its peak in 24-72 hours and normalization of CPK is aimed which assess patient recovery.[11] There is no consensus on treatment protocol and there are multiple methods aimed preventing end organ damage.[13] The aim of this study was to highlight the importance of using CPK in heat stroke as diagnostic tool and its role in assessing worsening prognosis with rising level.

METHODOLOGY

The study was carried out at Department of Medicine, JPMC, Karachi, Pakistan during 3 days from June 21st to 23rd 2015 and included 78 patients with clinical diagnosis of heat stroke, who survived 1st hour in hospital with emergency treatment. Patient with co-morbids like, stroke, chronic obstructive pulmonary disease and ischemic heart disease were excluded from the study**.** They underwent hematological and biochemical assay including serum CPK and LDH. Data were recorded with regard to vital signs, CBC, blood sugar, electrocardiogram (ECG), liver function test, urine analysis and CPK.

RESULTS

Out of 78 patients, 51 (65.3%) were male and remaining 27 (34.6%) were female. 41(52.6%) patients were above 50 and 27(34.6%) were below 50 years of age. Total expired patient were 42(53.8%), which included 33(78.8%) above 50 years (classical heat stroke) and 9(21.2%) expired with exertional stroke (Below 50 years).

Elevated levels of CPK were found in 55(70.5%) patients, out of them, 20(36.3%) expired who had CPK above 1000 IU. Seven patients that expired within one hour of arrival and these were patients who were not investigated or investigations could not be followed.

DISCUSSION

Classic and exertional (CHS, EHS) both are result of unusual high heat exposure and compromised thermo-regulation; former is result of heat and without unusual exertion and later is also unaccustomed exercise.[14] CPK is important test in heat stroke.[15] Aldolase and LHD are also raised but especially, CPK is associated with both EHS and CHS.

Hypernatremia is common especially due to decrease intake and dehydration, which is associated with heat stroke. Platelets may be low as patient is undergoing through disseminated intravascular coagulation (DIC).[16] Similarly, uric acid, BUN and creatinine are also rasied.[17]

CPK should ideally be raised EHS but classical heat stroke of elderly is also not spared. LDH and CPK stands out as unique, that despite non specific may points towards heat stroke especially in sporadic cases and even outbreak of heat stroke where it has key role to differentiate heat stroke from heat exhaustion.[17] The Karachi incident documented 1500 people in span few days. This is never described in history except in Ahmedabad (India).[18] People who are elderly especially those with co-morbids like stroke, diabetes mellitus, hypertension and arthritis, living lonely life compounded by delayed exit from closed space are susceptible to heat stroke. There is also dependence on patient part for access to water and fluid. Power failure also contribute to their miseries. There also another group of people who are on some antipsychotic medicine or illicit substance.[18]

CPK levels are with activity MM, MB, BB fraction which is not previously followed/available in our set up rather we went for total CPK level. The diagnostic importance of CPK in acute myocardial infarction and neuroleptic malignant syndrome (NMS) is not under estimated. Our study point that CPK has similar importance in heat stroke.[19]

Devastating heat waves are responsible for more deaths in the United States than floods, hurricanes, and tornados combined.20 Laboratory data in heat stroke is non-specific in majority of reported cases, CPK is >1000. CPK level in our patients in absence of MI or trauma was significant and early sign of heat stroke, remain to be established.[12]

CONCLUSION

Most of patient with heat stroke ended with multi-organ dysfunction and highest mortality in those with CPK more than 1000. Treatment aimed at decreasing the CPK, along with replacement of intravascular volume. CPK reaches it peak when it is associated with deteriorating renal function (a prognostic sign). Although CPK is non- specific test but it is worthy test for diagnosis and assessment of severity of disease.

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