MEDICAL CHANNEL

Original Article

DOCUMENTING THE UNPRECEDENTED 2015 KARACHI HEAT WAVE DISASTER. A HINT OF WORSE TO COME?

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Received on: 17-03-2016
Accepted on: 29-05-2016

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ABSTRACT

Background: Heat stroke is define as raised in body temperature to a level or above 41.1°C which may produce irreversible protein denaturation and resultant brain damage. Heat wave like that occurred in 2015 in Karachi can affect a major of part of population of an area and can be a serious burden on the health care system of the area, thus require advanced planning and awareness.**Aim:** To document the occurrence of a sustained catastrophic heat wave which struck Karachi in the summer of 2015.**Setting:** Medical UnitII, Jinnah Postgraduate Medical Centre (JPMC), Karachi. **Study Period:** June 22 to June 24, 2015, the peak days of the heat wave during which maximum loss of human lives occurred in the city. **Material & Methods:** All patients suffering heat stroke who were admitted as emergency patients in Medical Unit II, JPMC mostly during the period June 22nd to 24th, 2015. **Results:** A total of 78 heat stroke patients were admitted during the 3 day period. Of these, 42 (53.89%) had abnormally high temperature of less than 1 hour duration, while 36 (46.2%) had abnormally high temperature of greater than 1 hour duration. Of the, latter, 34 (94.4%) died and only 2 (5.69%) survived. Of the former group, 8(19%) died and 34 (81%) survived. Overall, out of 78 patients 42(53.8%) died in spite of emergency treatment, while 36 (46.2%) survived and were ultimately discharged. Of the 42 patients who died, 38(90.5%) died in less than 24 hours, mostly in less than 12 hours. Overall, out of 78 patients, 33 (42.3%) were comatose at the time of admission and another 29(37.2%) were semiconscious. All patients had rapid pulse. Creatinine phosphokinase (CPK) was found to be universally raised. **Conclusions:** This is evidence based study, an attempt to alert the people's community and decision maker.

Key Words: Heat wave, Heat Stroke, Karachi, Admission, Mortality

Med Channel 2016; 22 (2) 41-45

INTRODUCTION

Heat stroke is a medical emergency. It is a life threatening condition. The body's temperature controlling centre and medicines controlling body temperature fail. A person is said to be suffering from heat stroke when

temperature is greater than 40.6^{0}C (105^{o}F), and consciousness is altered[1].Patients usually have red skin, rapid pulse and shallow respiration. According to World Meteorological Association, ' heat wave' is defined as a sustained high temperature of at least 5 days duration when ambient temperature exceeds the average maximum by 5^{0}C (9^{0}F) and there is no nocturnal relief in temperature. Infact, majority of patients develop heat stroke during evening and night hours.[2]

Heat stroke is of two types (i) classic or common type which principally affects the elderly and infants, occurs when the body response is insufficient in countering the effects of the heat wave, and is associated with very high mortality[3] and (ii) exceptional heat stroke which occurs in young adults who are exposed to or subjected to accustomed or exertion in hot weather without adequate intake of liquids[4].

A number of conditions increase the risk for developing heat stroke. These include alcoholism, cardiac and renal diseases, obesity, parkinsonism, psychiatric illnesses, uncontrolled diabetes mellitus etc. Extreme of age and drugs such as diuretics, antihistamines, antipsychiatric medicines etc also increase the role[5]. Other factors or conditions which increase the risk of heat stroke include type of housing, air-conditioning facilities, climate, level of population, education, socioeconomic status, race, gender, ethnicity etc[6].

'Humidity' is defined as the amount of water in air which hampers the evaporation of sweat. The 'heat index' is the apparent temperature or the ratio of air temperature and relative humidity. For example, even in the presence of relatively lower temperature such as 30^{o}C (90^{o}F), a high humidity can lead to an apparent temperature or 'heat index' of 41oC or 106^{o}F. During the heat wave in Karachi, humidity was also high, so that when temperatures fell slightly during night time, the apparent temperature or heat index remained very high[7].

"Urban Heat Island" phenomenon occurs in urban areas where temperature is higher than in rural areas. There are multiple reasons for this such as abundance of artificially created dark surfaces which absorb heat like roads, roof tops, parking lots etc, lack of green areas due to inadequate plantation and vegetation, loss of free proper air flow, greater populated density and air conditions in certain areas which can cause increase of up to 2^{o}C in atmospheric temperature[7].

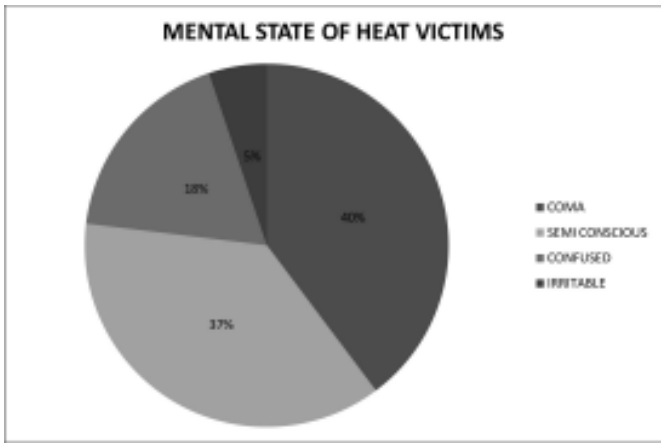
MATERIAL & METHOD

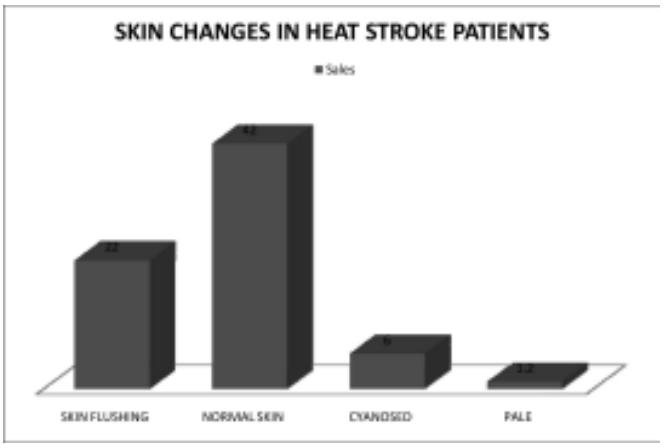
All patients suffering from heat stroke who were admitted in Medical Unit II, Jinnah Postgraduate Medical Centre (JPMC), and Karachi during the three day peak heat wave starting from June 22 to June 24, 2015 were included in the study. All underwent immediate emergency treatment such as immersion ice cold water or applications of cold sheets. Arterial blood gas (ABGs) measurement was performed. General demographic data was collected. Initial standard temperature readings were taken and subsequently, regular rectal temperature measurements were performed. All patients who survived for more than one hour underwent investigations including arterial blood gases (ABGs), complete blood count (CBC), blood urea nitrogen, serum creatinine / electrolyte, liver function test / serum total protein and protein A/G ratio, creatinine phosphokinase (CPK). Observational study design based on cross-sectional survey was used. The collected data was analyzed using SPSS Statistics version 15.0 for Windows.

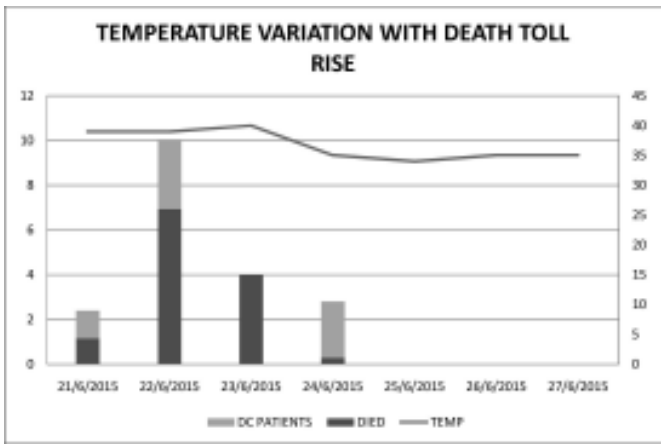
Inclusion criteria for the study were age not less than 25 years, temperature greater than 45^{o}C and those living in Karachi. We also included those patients who had end stage disease of major organs and also fulfilled the criteria for heat stroke.

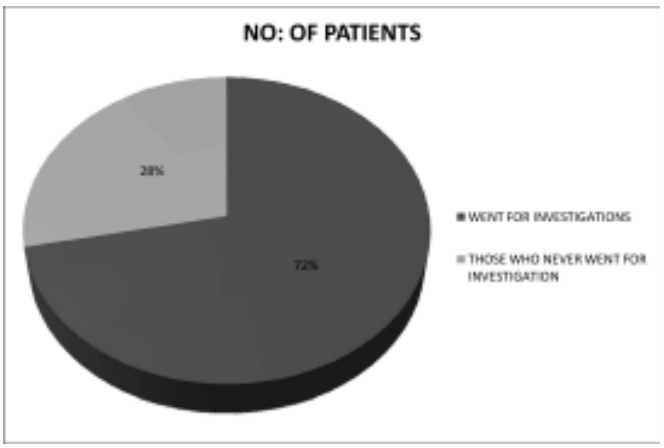
RESULTS

A total of 78 patients suffering from heat stroke were admitted through emergency in Medical Unit.II, JPMC during the three day peak of the sustained heat wave. The peak lasted from 22nd to 24th June, 2015. During these three days, the city's temperature went on increasing progressively and there was no nocturnal relief in temperature. It created havoc in the city and heat stroke victims in large numbers were rushed to various tertiary care hospitals and other hospitals in Karachi. All patients who were received in our ward were in very serious condition when admitted and their condition continued to deteriorate after admission and in spite of emergency measures such as immersion in ice water tub or provision of ice packs. Out of 78 patients, 36 (46.20%) had abnormal temperature duration of greater than 1 hour while 42 (53.8%) and abnormal temperature of less than 1 hour duration. Of the 36 patients with high temperature of more than 1 hour duration, as many as 34 (94.4%) died and only 2 (5.6%) survived. Of the 42 patients with abnormally high temperature of less than 1 hour duration, 8(19%) died, while 34(81%) survived. Thus out of 78 patients, 42 (53.8%) died and 36(46.2%) survived. All 78 patients









were given emergency treatment (as described above). Even then, the large majority of patients with abnormally high temperature of greater than 1 hour duration died.

Of the 78 patients, there were 52 males (66.7%) and 26 females (33.3%). Ages of the patients ranged from 25 to 85 years. Mean and median ages were 54 years and 57 years respectively. Of the 42 patients who died, 21 (50%) were less than 60 years of age while 21 (50%) were 60 years or older. Of the 36 patients who survived, 22 (61.1%) were under 60 years of age while 14 (38.9%) were 60 years or older. Out of 78 patients, 42 (53.8%) had one or more co-morbids such as hypertension, diabetes mellitus, ischemic heart disease, bronchial asthma etc. Of these, 21 (50%) died and 21 (50%) survived. Of the 78 patients, 35 (44.9%) had normal pulse at time of admission, 22 (28.2%) had weak pulse and 21(26.9%) had a bounding pulse. All 78 patients had rapid pulse rate ranging from 110 to 166/minute. Out of 78 66 patients (84.6%) had a temperature of 103°F or above at the time of admission, 11 (14%) had a temperature of 102°F and 1 patient (1.3%) had a temperature of 101°F. Of the 78 patients, 35 (44.9%) had a normal arterial blood pressure (systolic pressure between 100-130 mmHg and diastolic pressure between 70 and 90 mmHg), while 15 patients (19.2%) had high 140/190 mmHg or higher and 28 (35.9%) had low (< 100/70 mmHg) arterial blood pressure. Of the 78 patients, 33 (42.3%) were comatose at the time of admission, 29 (37.2%) were semi conscious, 12 (15.4%) were confused and 4 (5.1%) were irritable. Of the 42 patients who died, 38 (90.5%) died in less than 24 hours, the large majority in less than 12 hours. All the above and general other variables are outlined in graphical presentation.

DISCUSSION

The increased incidence of heat waves in recent times globally has been attributed to global warming. Studies show that extreme heat episodes have been associated with more deaths in the United States than floods, tornadoes and hurricanes combined[8].

The catastrophic heat wave that struck Karachi in June 2015 was a calamitous event which resulted in a huge loss of precious human lives. It is estimated that

over a thousand people died of heat stroke in less than a week. Such a heat wave had never before occurred in Karachi's history and the only comparable event in the region was the heat wave which struck Ahmedabad, India in 2015[9,10]. As there had never been a heat wave of this intensity in Karachi's history, the 2015 summer heat wave created havoc. The people had little or no understanding of the damaging effects of heat waves[11]. Most of the dead were the poor and destitute , mostly old who lived on the streets of Karachi, and who once the heat wave peaked, were totally exposed to the brutal sun, and neither shade or shelter to protect themselves nor adequate fluids to drink or to cool themselves. There was no literature on heat waves in Karachi and no predictable pattern for occurrence of heat stroke in Karachi region or where else[12]. The government and other civic institutions were found failed in controlling the situation. Death as a result of heat stroke needs to be differentiated from death in patients who have significant co-morbid (suffering from diabetes, hypertension, heart disease, psychiatric illness etc.) in whom the heat stroke only acts as a facilitator in the presence of their major co-morbids[5, 13].

Public needs to be educated regarding preventive measures such as avoidance or restriction of outdoor activities in summer, wearing loose fitting and light colored clothing, staying in cool and shady places especially during temperature, and avoidance of coffee, alcohol etc. In many cases, people continued their usual activities in the open, thus exposing themselves to the harsh rays of the sun; most people did not take any meaningful precautions even during the peak of the heat wave[14].

It needs to be emphasized that early recognition of heat stroke is vital so that immediate treatment and resuscitation measures may be instituted. However, it is important to distinguish patients suffering from heat stroke from those patients who are suffering from heat exhaustion which is a less severe condition. Patients with heat exhaustion usually respond well to treatment[16].

As mentioned above, the presence of co-morbids increases the risk of death in patients suffering from heat stroke. However, even in the absence of co-morbids and even in otherwise healthy young patients, a delay in recognition and start of emergency treatment greatly increases the risk of death. This explains why so many young people and so many people without significant co-morbids also died. A delay in start of treatment can lead rapidly to multiple organ failure thus hastening the march to death[13].

There is another group of patients who develop multiple organ failure which is secondary to delay in approaching medical help.[13]

By definition, heat stroke patients might have neurological symptoms ranging from disorientation to coma. (See above).[14, 15]

Compared to our study, all mortality rates is 53% contemporary studies from Korea[16], Germany[12], USA[17], China[18] and Australia[19] but in our study 53% mortality is unique, that it occurs in 3 days only.

Liver disease is uncommon and associated with raised liver enzymes but fulminant liver failure is rare[20].

All patients underwent ABGs and there was high incidence of metabolic acidosis. This finding is supported by other studies.[21]

CPK is grossly raised in other studies. It has prognostic and diagnostic value[22] and our study no exception.

Renal dysfunction was variable in our patients and study may have been due to acidosis, rhabdomyolysis, dehydration and congestive cardiac failure (CCF) etc. [23].

The short but calamitous heat wave which struck Karachi in the summer of 2015 resulted in the loss of over 1300 documented precious lives[24.] The big question remains: why did such an unprecedented phenomenon happen and even more importantly: will it happen again? Whether it occurred due to some changing local climate pattern or due to a global phenomenon like global warming, the important thing to remember is that such a heat wave may happen again. It is essential that the next time this happens; we as a city are fully prepared. We must urgently upgrade our ambulance and hospital (especially emergency services) facilities, significantly improve our power generation and distribution system (especially in the peak of summer when demands are highest and when it routinely breaks down) and educate the people regarding the measures that need to be taken to prevent people from developing heat stroke in the peak days of summer. We should improve our weather forecast and warning systems so that the people are alerted in advance and can take adequate precautionary measures. Special arrangements need to be in place in hospitals with the advent of the summer season to enable them to cope with such a situation[25,]

CONCLUSION

The share number of deaths that resulted from last year is heat wave has no parallel. Even the heat waves that occurred on Ahmedabad, India in 2010 and 2015 (two heat waves with high mortality rates) did not result in such a large number of deaths. Our study is an attempt to document this devastating heat wave which claimed so many precious lives and to raise the alarms that this might happen again, that we are grossly underprepared when it does happen, and that we need to take urgent measures on a top priority basis to prepare ourselves for such a heat stroke in future and to even that if such a heat wave occurs again, the loss of precious lives can be minimized as such as possible. This study is a wakeup call for the Government and other civic agencies to act before it's too late. This study is evidence based to alert the concerns about heat stroke which is unique as it lead to massive massacre in only 3 days. The incidence of such high mortality on account of heatstroke is seldom reported.

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Authors contribution:
* Concept of studty, data collection, ** Drafting the article
*** Literature search

Conflict of interest: Non declared