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Heat stroke in closed car

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Abstract: Heat stroke, also known as sun stroke, is a severe heat illness, defined as hyperthermia with a body temperature greater than 40.6 °C (105.1 °F) because of environmental heat exposure with lack of thermoregulation. Children left unattended in stationary cars can face several dangers which are unknown to general population. In a developing country like India the dangers associated with children and parked cars are yet to be recognized and conveyed to the normal population who are seemingly ignorant about this issue. We represent a case of three year female child who was found dead in parked car during marriage party. The authors intend to highlight the dangers associated with small children left unattended or getting locked in cars during play.
Keywords: Heat stroke, Hyperthermia, Closed cars, Hyperthermia, Congestion, Edematous

INTRODUCTION

Motor vehicles such as cars have become a basic needs and necessity for families now a day. They have become the landmarks of prestige and identity. However, with the advent of the modern society there are some another aspects of its black truth. Leaving children unattended in such vehicles is one such practice. Each year, children die from heat stroke after being left unattended in motor vehicles. It is also possible that sometimes the child may get accidentally locked in the vehicle during their play. This, however, involves several dangers which are unknown to general population. Causes like heat stroke, asphyxia by power windows, fires, carbon monoxide poisoning, etc, have been reported to be responsible for deaths of children [1]. Here we present the case of three year child who was found dead in her father's car when she went to attend a marriage party with her family.

CASE REPORT

A three years female child went to attend a marriage party by car along with her parents and six years old brother. They parked the car and unfortunately forgot to lock it. Her parents were busy in party. The siblings returned back to their car while playing. During playing accidently they got locked which the children were unable to unlock. After about three hours, the parents noticed the missing children. They spent about two hours searching while finally found them into their locked car. On opening the car, both the children were found unconscious. They rushed to our hospital and were admitted in the pediatric intensive care unit. Even after best efforts the female child could not be survived. A diagnosis of heat stroke was made by the treating doctors. The body was brought to our department for postmortem examination.

Autopsy Findings

The length of the body was 92 cm. Rigor mortis was present over the both eyelids, facial muscles, both the upper limbs and was in developing phase. No external injury was present over the body.Brain was congested and edematous. Trachea and bronchi contained frothy haemorrhagic fluid. Bilateral pleural cavity contained about 150 ml of straw coloured fluid. Both the lungs showed congestion. Liver was congested. Both the kidneys showed congestion.Viscera were preserved for toxicological analysis, which was reported negative for all common poisons. On histopathological examinations, lungs showed odema and marked congestion, Liver showed centrilobular necrosis. Both kidneys showed congestion and odema. These findings were suggestive of heat stroke.

DISCUSSION

Hyperthermia is a condition in which the body temperature rises above 106^0F i.e. 41.5^0C. At autopsy, there are no diagnostic anatomical criteria for heat stroke [2]. Children are more prone to develop heat related injuries as they have a higher body surface area and their heat regulating mechanisms are not as developed as adults. On sunny days, even when the ambient temperature is mild or relatively cool, there is rapid and significant heating of the interior of vehicles. The rise in temperature in standing vehicles is significant even at cool ambient temperatures, with 80%

of the rise occurring in the first 30 minutes, putting an individual at risk of hyperthermia [3].The heat illness is a continuum that is divided into 3 phases. The mildest form is heat stress, the physical discomfort and physiologic strain as a result of a hot environment. Next is heat exhaustion, a mild to moderate illness associated with dehydration and a core temperature ranging from 37°C to 40°C. Symptoms of heat exhaustion include intense thirst, weakness, discomfort, anxiety, dizziness, fainting, and headache. Finally, heat stroke is a life-threatening illness characterized by an elevated core body temperature >40°C with central nervous system dysfunction resulting in delirium, convulsions, coma, and death [4]. Young children and infants are more susceptible to heat illness than adults for several reasons. As these group of individuals may not be able to open car doors or to express discomfort verbally (or audibly, inside a closed car), their plight may not be immediately noticed by others in the vicinity. It is recommended that parents put their purse, wallet, or anything that is valuable in the backseat so that when they get their items out of the backseat they can see that their child is there as well. For larger groups in a van or bus, checking for stragglers at the end of the trip is essential, complemented by other procedures such as a head count [5]. Physiologically, toddlers and infants, despite their increased body surface area to mass ratio, seem to have less effective thermoregulation in comparison with adults as proposed by Tsuzuki-Hayakawa and Tochihara [6]. In their study, they demonstrated that children (aged between 9 months and 4.5 years) who were placed for 30 minutes in rooms that were 35°C (95°F) had a rectal temperature that increased more rapidly and was significantly higher than their mothers'. This was despite that children and infant perspire more by body mass in comparison with their mothers. This finding was speculated to occur because smaller masses warm more quickly and that young children have an immature thermoregulatory system.In addition to the potential physical and physiologic differences, adults have the ability to modify behavior on the basis of the environment. They can undergo cooling measures: take off excess clothing, obtain cold drinks, and seek cooler environments (eg, get out of a hot car). Among recent child deaths in hot cars, approximately half occurred because parents forgot that the child was in the car, 18% happened after parents intentionally left the child in the car without understanding how hot it could get, and 30% happened after the child climbed into the car to play [7-9]. Legal prosecution of parents in these situations can vary greatly. In separate incidents, a college professor in California forgot that his son was in a hot car, and a horse groomer in Florida knowingly left his daughter in his car during horse races. Each resulted in the unintentional death of a child; the college professor was never prosecuted, while the horse groomer was sentenced to 20 years in prison followed by deportation [10]. Between 1998 and 2011, at least 500 children in the United States died from being inside hot cars and 75% of the victims were less than 2 years old. When the outside temperature is 21 °C (70 °F), the temperature inside a car parked in direct sunlight can quickly exceed 49 °C (120 °F) [11]. In a developing country like India the dangers associated with children and parked cars are yet to be recognized and conveyed to the normal population who are seemingly ignorant about this issue. So, such kind of fatalities is infrequently reported [12-13].

Conclusion and Recommendations

- Parents of small children should not leave them in the locked cars even when the outside environmental temperature is moderate.
- Cars in houses having small children should never be left unlocked when not in use.
- Parents should be particularly vigilant when the child is playing near the cars as they might sneak in, but may not know how to get out of the vehicle, thus endangering their life.
- It is recommended that parents put their purse, wallet, or anything that is valuable in the backseat so that when they get their items out of the backseat they can see that their child is there as well.
- For larger groups in a van or bus, checking for stragglers at the end of the trip is essential, complemented by other procedures such as a head count**.**
- There should be proper education of the population through the newspapers, television or other medium about the heat related dangers to the children in parked cars.
- There should be proper investigation by the police so as to fix accountability about the negligence, if any, which caused the death of a child in such cases.
- This case highlights that not only established hyperthermia but also prodromal symptoms can result in death especially in children.

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