

Case Report

Forensic approach to a case of death due to burn injury: a case report

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ABSTRACT

Injuries due to burns are known to have a very high mortality. Burn injuries occur due to a variety of thermal, electrical, mechanical products and can be accidental, suicidal or even homicidal in nature. As the inquiry and research are limited to identifying patterns and causes for burns, the accurate originator and mechanisms are not clearly known. Herein, we report a case of 25 year old female died due to ante-mortem burn injuries with soot particles found in trachea.

Keywords: Burn, Mortality, Inquiry, Research

INTRODUCTION

There are a variety of types of lethal and nonlethal thermal injury, including flame burns which char skin and singe hair, scalding from hot fluids, and contact burns those results from touching hot objects. Burn injuries are the global public health problem, the incidence is estimated to be around 265000 deaths per year. In India, every year 1000000 people are moderately or severely injured due to burn injury.¹ The accidental burn injury is the commonest manner of burns.² Fatal residential fires account for 10% of all accidental deaths in developed countries, with one-fourth of the deaths involving elderly people. Burns is the important mode of suicide and homicide in the world. Burn injuries are the 4th utmost common type of trauma all over the world, following traffic accidents, falls and interpersonal violence.³

A variety of factors may lead to fire fatalities. The most frequent are smoke inhalation and burn injury. Examination of victims who have died from smoke inhalation usually reveals soot in the nostrils and mouth as well as burns, and coating of the larynx, trachea, and bronchi at autopsy. Soot can be detected with the naked

eye 2 or 3 days after inhalation of smoke.⁴ The extent of the burn is determined by the classic "rule of nine": the head (9% of body surface), the upper extremities (each 9%), the front of the trunk (18%), the back (18%), each lower extremity (18%), and the perineum (1%). Most victims of house fires die from exposure to carbon monoxide gas or at least are affected by it. In enclosed areas, in addition to carbon monoxide, hydrogen cyanide is responsible for death from smoke inhalation. About 45% of the burns patients are dying due to septicemia.⁵ It is often crucial to determine what represents ante mortem vs. post mortem burning, reddening of the edges of the burns may point to an ante-mortem aetiology, but this is not conclusive.⁶ The medico-legal investigation in case of deaths due to burns deals with the manner of death and cause of death, in cases of spot deaths, time since death, the nature of burn injuries i.e. ante-mortem or post-mortem are important, besides it is associated with societal problems.⁷

CASE REPORT

A 25 year old female was brought dead to our tertiary care hospital casualty following fatal thermal burn injuries. Body was brought to our department for post-

mortem examination. History revealed that the deceased was recovered from the burnt house without knowing the cause of burn. The deceased was a moderately built adult female. Rigor mortis was found all over the body and post-mortem lividity was not appreciated because of extensive burn injuries. Pugilistic attitude was noted during external examination and this pugilistic attitude is characteristic of heat effect on the muscles to cause contraction and resultant positioning to imitate the stance of a boxer. Dermo-epidermal burn injuries were found all over the body. Heat ruptures of various size and shape present on the head, both upper limbs, both lower limbs and dorsal aspect of both feet. Internal examination disclosed soot in the upper airways and the intrapulmonary bronchi, and cherry-red coloration of the blood, muscles, and congestion of all visceral organs. The viscera were sent for chemical analysis and the toxicological analysis was reported as negative.

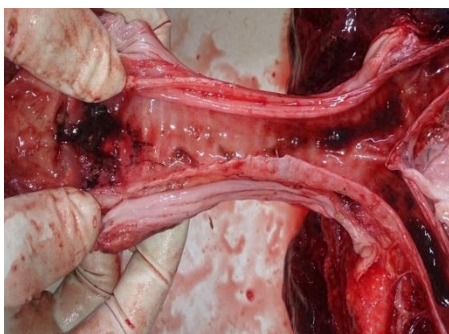


Figure 1: Soot in airway.



Figure 2: Heat rupture found over the left side of forehead and face.



Figure 3: Extensively burned body with pugilistic attitude.

DISCUSSION

Accidental deaths by fire mostly involve children and elderly people playing with or using matches and lighters. Fires in confined spaces such as a room can produce a phenomenon called a flashover, often involving a gas heater or device. Once a fire starts, it produces radiant heat, hot gases, and smoke. Self-immolation is dramatic death by fire, and mainly occurs in adults between the ages of 20 and 40 years, who are suffering from significant mental disorders or with a history of alcohol or substance abuse. Suicide attempts usually pour a flammable liquid on themselves, generally gasoline, and set themselves on fire. The use of a flammable liquid is the most common method of immolation. The liquid container and matches or lighter are usually present at the scene. Generally, such suicidal attempts present third-degree burns over most of their body, with the burns concentrated on the front part of the body.

Thermal injuries are common and often complex, complicated by commingling and fragmentation. Tasks include determining at autopsy whether the person was alive or dead when the fire started. Evidence of survival is dependent on the documentation of all potentially fatal injuries and examination of individuals overcome by smoke inhalation will usually reveal soot in the nostrils and mouth as well as coating the larynx, trachea, and bronchi (Figure 1). Soot particles and other thermal injuries indicate that the patient was breathing in fire. Absence of soot particles does not prove that the patient was already dead when the fire started unless there is a reasonable evidence that the fire was not a flash fire.⁵ The pugilistic attitude seen in charred bodies refers to the arched back, elevation of the arms, and mild flexion of the hips and knees that resemble the stance of a boxer (Figure 2). This posture is due to heat effect on the muscles, causing some muscle groups to contract as they coagulate, pulling the parts of the body into this characteristic position. Also, the skin may split superficially in areas and resemble incised wounds⁸ (Figure 3).

Deposits of soot in the airways should never lead to the premature conclusion that the victim died of intoxication from fire fumes. Soot particles may, under certain circumstances, occur in the respiratory tract also if the burning was exclusively after death. In homicidal deaths, where victims are burned to hide the method of death, accelerants cannot be detected in the blood, soot cannot be found in the airways, and carboxyhemoglobin concentrations are not higher than those found in smokers. There are numerous cases in which there was no soot in the larynx or trachea, yet analysis of blood for carbon monoxide revealed lethal levels.⁹ Introduction of soot into the trachea, either during incision on the charred neck at autopsy or by disintegration from burning, gives the false impression of smoke inhalation.¹⁰ But the reported case, the soot particles were seen all along the respiratory tract from the trachea to the terminal bronchi

and was found adherent to the mucosa admixed with mucus including ante-mortem inhalation of soot particles.

CONCLUSION

An important observation in fire deaths is the inhalation of smoke, as confirmed by examination of the upper-airway trachea/bronchi for surface soot. The absence of soot in the respiratory tract does not allow in drawing the conclusion that exposure to the fire occurred after death. Apart from the soot inhalation as a vitality parameter, there are other vital signs that include, line of redness, vesicles / blisters contain serous fluid, infection, inflammation of the base of the blister, healing with granulation tissue, inflammatory reaction, increase in enzyme reaction and >5% COHb in blood. The significance of one vitality parameter alone is therefore limited.

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