Case Study

Autopsy Based Findings in Fatal Blast Cases: A Case Series

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Abstract

Blast incidents resulting trauma and deaths are serious health issues. Blast incidents could be either accidental in a military or industrial setup or homicidal as an act of terror. Suicidal blast incidents are uncommon. This article briefly reviews the various types of injuries examined medicolegally by the authors in deceased in blasts cases, to know the various causes of death noted in different autopsies and the factors on which the fatal injuries sustained depends.The different varieties of burns like flame burns, scalds, charring and other associated injuries due to blast like lacerations of skin and muscles due to direct trauma, lacerations of viscera and rupture of hollow viscera due to blast waves etc. may be seen in person as per nature of blast. In present case series, authors observed the injuries over the bodies and other findings were consistent with the alleged history of incidences. However, other factors like scene of crime, type, pattern and distribution of injuries over the body, conditions of the clothings, if available etc are helpful in deciding the cause and manner of death. Determination of the manner of death in blast cases is chiefly the task of investigating agencies and the role of forensic pathologist is contributory. However, a forensic pathologist may play a crucial role in deciding the manner of infliction of injuries or death and helps the investing agency and Hon'ble Courts in deciding the case and delivery of justice to victims of blast cases by visiting the scene of incidence, pursing the types, patterns and distribution of injuries over the victim of blast and considering the inquest report.

Keywords: Blast, Burns, Injuries, Haemorrhagic Shock, Neurogenic Shock, Crime scene.

Introduction

The cause of death as described in literature is the disease or injury responsible for starting the sequence of events, which are brief or prolonged and which produce death[1]. Determining the final cause of death begins at the end of physician who declares the death

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and document the chain of events that leads to death including the history, clinical findings of patient, resuscitative measures and response of patient towards them along with a provisional cause of death. However, in medicolegal cases, the final cause of death is ascertained by the forensic pathologist who correlates the autopsy findings over the body and the circumstantial evidences reported by the forensic scientist from the scene where incident happened. There are various objectives of a medicolegal autopsy including identification of the individual in cases of unknown dead bodies, determining the cause and manner of death, documenting malformations, obtaining and retaining various biological samples for further examination/analysisetc[2]. The need for conduction of a medicolegal autopsy occurs in unnatural deaths i.e. accidental, homicidal and suicidal. The manner indicates the circumstances under which the person died. It is established from the personal and family history, circumstantial information from the scene of death, witnesses of the event, information from family members and others and by the autopsy findings[1]. Different modes of injuries results into different types of injuries in a single incident. The simulation of injuries sustained due to various mode of injury is another question to be solved by the forensic pathologist during autopsy. The contributory role of forensic investigation team has also been discussed. A blast means destructive wave of highly compressed air spreading outwards from anexplosion[3].

Here in the presented case series, we are discussing various types of injuries examined medicolegally by the authors in deceased in blasts cases, to know the various causes of death noted in different autopsies and the factors on which the fatal injuries sustained depends. However, determination of the manner of death in blast cases is chiefly the task of investigating agencies and the role of forensic pathologist is contributory.

Case Discussion

Case No. 1: A young married female while working in the kitchen at her home encountered a fatal incident of blasting of cooking gas cylinder and was brought to our medical facility. The treatment like proper dressing with silver sulfadiazine ointment to prevent infection, various fluids to prevent dehydration and maintain electrolyte balance etc. was given to save the life of victim. However, the patient died in the hospital during treatment due to severity of burns as total body surface area involved by burns was about 95 percent. As the burns were severe, prognosis was very poor and patient succumbed to death. On requisition by the investigating agencies, the autopsy was conducted. At the time of postmortem examination, white surgical bandages were wrapped all around over the brunt area except face with silver sulfadiazine ointment however sulfadiazine ointment is present over the face. On postmortem examination, singing of scalp hairs, eyebrows, eyelashes, axillary hairs were noted. On further examination, superficial to deep burns were present over head and face, neck, front and back of chest and abdomen, front and back of both upper and lower limbs. Only small area of lower limbs at places and perineal region which was covered tightly by undergarments, were escaped from burn injury. Unhealthy granulation tissue was present at places over the brunt surface area. All the viscera were found congested. The cause of death in this case was opined as described burn injuries and its complications i.e. sepsis (Fig. 1)

Figure-1 Showing Burns injuries over the Figure-2 Showing charing of body victim of cylinder blast while cooking during blast in paint factory

Case No. 2

In a paint factory, a blast into the boilers happened and resulted into the instantaneous death of a 2-year-old female child playing there nearby while her parents were working in the factory. The child was brought to the hospital where she was declared dead. As the insurance claims were involved in this case, an autopsy was conducted on the request of Police in our institute. The body was received naked and

was wrapped in sheet of cloth. On postmortem examination, scalp hairs, eyebrows and eyelashes were found completely burnt off. On further examination, charring was observed over head and face, neck, front and back of chest and abdomen, front and back of both upper and lower limbs and perineal region. The child was in pugilistic attitude as a result of heat-related contractures. Epidermis was burnt off at places, hence missing at places. Reddish discoloration of skin was noted on brunt area where epidermis was missing. Soot particles were found in the oral cavity and respiratory tract at places. All the viscera were found congested. Neurogenic shock due to the burn injuries present over the body was the cause of death in this case. (Fig. 2). The working conditions of the factory for the workers were usually not up to the mark and as per guidelines issued time to time by the concerned competent authority. In the present case, mishappening at least to the child is preventable as parents are not supposed to bring the children at factory during the working.

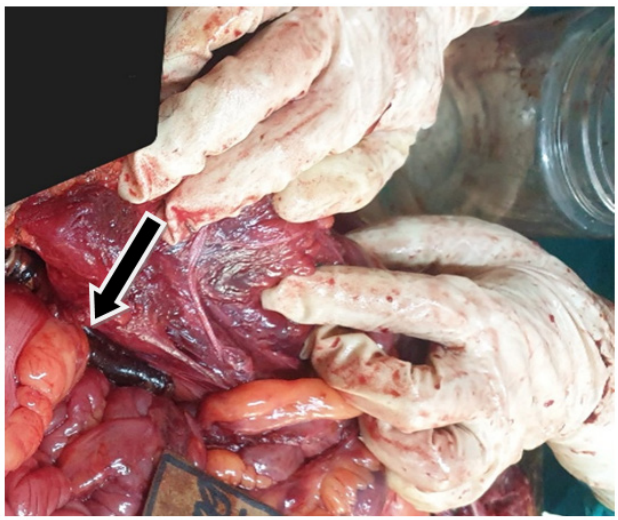

Figure 3: Showing piece of metallic pipein abdominal cavity in victim of blast of automobile tool industry

Case No. 3

A factory worker of automobile tools industry succumbed to the injuries sustained due to blast in the boiler. The body was received in our department for medicolegal autopsy. On examination, superficial burns were noticed over the dorsal aspect of the right foot and adjoining lower leg constituting about five percent of total burn surface area which was not sufficient to cause death in the ordinary course of nature. Singing of body hairs were not noticed on the body of deceased. Cloths were also not brunt. However, a lacerated wound was found over the anterior abdominal wall. On dissection and exploration of abdominal cavity, peritoneum was found breached and a piece of metallic pipe was found in the peritoneal cavity [Figure-3]. The peritoneal cavity contained about 3 litres of fluid blood. The organs were found pale. The cause of death in this case was opined as haemorrhagic shock due to the described injury. In many of the industries, working conditions are not favourable and not in accordance to the established rules and regulations. Many of the instances of misshaping to the workers working in various industries may be prevented by taking proper safety measures i.e. by wearing protective gears by workers, time to time checking of the machinery/ equipments, enough space for workers and proper measures to combat any mishappning due to fire incidence etc. In the present case no protective gear were used by the deceased to protect himself from any mishappening and immediate proper measures were not available in the factory to save the life of workers and other related persons working in the industry [Figure No. 4 and 5 were of scene of incident of present case].

Figure 4 **Figure. 5**

Showing scene of incidence of blast in automobile tool factory

Case Discussion

The injuries sustained over the body in an incident of blast and their fatality depends over various factors described here:

The source of blast: The injuries sustained over the body depend on the distance of the person from the epicentre of blast; the effect of disruptive wave produced at the point of blast varies with the distance. Shrapnel have less range than the shock wave produced. However, the part of the body effected decides the fatality of the injury present.

Type of injury: Burns are the most common injuries sustained over the body in an incident of blast as observed/noticed in the above discussed autopsy reports. All the three deceased had burn injuries ranging from superficial burns to charring of the body.

Discussion

Bombings and blasts have the potential to inflict multiple and devastating injuries to a large number of victims simultaneously and without warning. On account of the variety of circumstances involved in such events (e.g., indoor vs. outdoor, size of the explosive charge, distance of victims from the explosion, presence of secondary debris and of biological or radiological contaminants, structural collapse), each bombing event is unique[4].

Explosions are physical, chemical or nuclear reactions that involve the rapid release of considerable amounts of energy. Their deleterious effects on living organisms are embodied by the term blast injury. The incidence of injuries resulting from explosions has increased throughout the twentieth century. This has been caused in part by industrial expansion[5].

An explosive material is a reactive substance that contains a great amount of potential energy that can produce an explosion if released suddenly, usually accompanied by the production of light, heat, sound, and pressure. It is of two types: (1) High order explosive: which after detonation produces instantaneous high pressure rapidly expanding gases which compress the surrounding air resulting into supersonic over pressurization shock or blast wave followed by negative pressure (suction) wave which lasts for about 5 times. (2) Low order explosive: which undergo deflagration instead of detonation thereby releasing slow energy as compared to high order explosives resulting in subsonic explosion lacking over pressurization blast wave; examples are pipe bombs, gunpowder and most pure petroleum-based bombs such as Molotov cocktails[6].Abdominal injuries include abdominal haemorrhage and abdominal organ perforation and laceration. Blast injury to the gastrointestinal tract (GIT) should be suspected in any victim with signs and symptoms that include abdominal pain, rebound guarding, absent bowel sounds, nausea, vomiting, hemetmesis, rectal pain, testicular pain, or with unexplained hypovolemia[7]. In an autopsy case of accidental blast of low order explosive, body of the victim showed approximately all patterns of injuries because he was very close to the centre of the blast[8]. Victims of blast injuries were examined medicolegally and different types of mechanical injuries were noticed including the thermal burns and blast lung[9]

Blast injuries include both physical and psychological trauma. Physical trauma includes fractures, respiratory compromise, injuries to soft tissue and internal organs, internal and external blood loss with shock, burns, and sensory impairment, especially of hearing and sight. Five mechanisms of blast injury have been described. 1. Primary which is due to impact of supersonic blast wave on body which preferentially affects hollow or gas-filled structures? Mild traumatic brain injury (concussion) may also be observed 2. Secondary due to impact of debris from blast onto body that primarily causes penetrating or blunt injuries. 3. Tertiary is due to impact of body thrown by blast onto environmental surfaces or debris causes fractures and traumatic amputations and closed and open brain injury. 4. Quaternary- Processes independent of primary, secondary, or tertiary blast injury (e.g. burns, toxic inhalation, crush injury from entrapment under debris, aggravation of medical disorders) it causes burns, crush injuries with rhabdomyolysis and compartment syndrome. Respiratory tract injury from inhaled toxicants, asthma, angina, or myocardial infarction may be triggered by the event 5. Quinary- These are the injuries resulting from toxic materials absorbed by the body from the blast and post detonation environment (e.g. radiological, biological substances) which causes radiation burns or acute radiation sickness[10].

By visiting the scene of incidence, pursing the types, patterns and distribution of injuries over the victim of blast and considering the inquest report, a forensic pathologist may decide the manner of infliction of injuries or death and helps the investing agency and Hon'ble Courts in deciding the case and delivery of justice to victims of blast cases.

Conclusion

The cause and manner of death in every medicolegal case is must to know. However, in

cases of blast, it is a challenging task to determine manner of death because of the effect of blast on body by different patho-mechanics. However, a forensic pathologist from meticulous autopsy, crime scene investigation, personal and family history, circumstantial information from the scene of death, witnesses of the event, information from family members and others may decide the manner of infliction of injuries or death and helps the investing agency and Hon'ble Courts in deciding the case and delivery of justice to victims of blast cases and met the objectives of a medicolegal autopsy. Further, incidence of mishappning and injury/fatality to the concerned persons of factory may be decreased by wearing protective gears by workers, time to time checking of the machinery/equipments and availability of proper measures to combat any mishappning due to fire incidence etc.

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