

Accidental Industrial Oven Blast Injury: A Case Report

Rajeev Kumar¹, Shiv Shankar², Dara Sandeep³, Jyothi Panchal⁴

¹Professor, SHKM Govt. Medical College, Nalhar, Nuh, Haryana 122107, India

^{2,3}PG Resident, Department of Forensic Medicine, SHKM Govt. Medical College, Nalhar, Nuh, Haryana 122107, India
Corresponding Author Email: [shivshankarmbbs\[at\]gmail.com](mailto:shivshankarmbbs[at]gmail.com)

⁴Junior Resident, Department of Dermatology, SHKM Govt. Medical College, Nalhar, Nuh, Haryana 122107, India

Abstract: A blast is a process where any substance or device, capable of creating a sudden gas expansion, releasing potential energy and thus creating a pressure wave damaging the surrounding objects. Blast injury is becoming more common in non-military population due to terrorist acts and unsafe use of explosive equipment and substances, but it is still rare to see such injuries and deaths. Accidental blasts normally occur at work place which results from handling of potentially hazardous equipment by untrained, unlicensed individuals or by the use of faulty, under maintained equipment. The interpretation of blast injuries carries great importance in understanding the patho-mechanism of these injuries, to correlate the autopsy findings with the circumstances of the case and also help in the management of blast victims. Therefore, an autopsy surgeon should know the peculiarities of blast injuries. We hereby report a case of a 34year old male who was a blast victim of an industrial oven on which he was operating. All the peculiarities and typical features of blast injuries were present at autopsy and an effort was made to correlate the autopsy findings with the circumstances of the case.

Keywords: Oven, blast injury, explosion, charring, traumatic amputation

1. Introduction

A blast is a process where any substance or device, capable of creating a sudden gas expansion, releasing potential energy and thus creating a pressure wave damaging the surrounding objects. Compression of the air in front of the pressure wave, which heats and accelerates air molecules, leads to sudden increase in atmospheric pressure and temperature transmitted to the surrounding environment as a radially propagating shock wave, known as the “Blast wave”. Blast injury is becoming more common in non-military population due to terrorist acts and unsafe use of explosive equipment and substances, but it is still rare to see such injuries and deaths. Accidental blasts normally occur at work place which results from handling of potentially hazardous equipment by untrained, unlicensed individuals or by the use of faulty, under maintained equipment. (1)

Oven blast injuries are not very uncommon and they occur due to over pressure and leakage. Ovens are commonly used in households and also in certain factories. Ovens in the factory are large when compared to households and produce greater amount of explosion and injuries. (2)

Blast injuries are classified into four main categories (3)

- Primary blast injury: They are due to direct effect of “blast overpressure”. Injuries are caused by compressed air, which tends to affect air-filled organs like lungs, stomach, intestine, middle ear etc.
- Secondary blast injuries: They are caused by flying objects (missile/splinter) generated by the blast.
- Tertiary blast injuries: These injuries occur when victims are thrown into air and strike other objects.
- Miscellaneous blast injuries: These comprise injuries from flame, falling masonry etc., which are the consequences of the blast.

Here is a case report of 34year old male who was a blast victim of an industrial oven on which he was operating. All the peculiarities and typical features of blast injuries were present at autopsy and an effort was made to correlate the autopsy findings with the circumstances of the case.

2. Case History

A 34-year-old male dead body was brought for medico-legal autopsy. According to the relatives of the deceased, eye witnesses and the accompanying police, the person was working as an engineer in a factory. While he was using an oven, suddenly the oven exploded and he sustained injuries to his body. After the incident he was rushed to a nearby CHC where he was declared brought dead. The body was kept in cold storage for about 19 days due to issues of permission from the embassy as he was a foreign national. On the 20th day on the request of investigating officer, after obtaining permission from embassy and reaching the attendants of deceased to the hospital, the autopsy was done.

Autopsy findings:

The body was wearing a torn and burnt maroon colour round neck T shirt with only small burnt fragment present around the neck and chest region whereas the rest of the body was naked. The body was darkly discolored due to soot deposition with superficial to deep burns along with charring of tissues present mainly over the lower trunk and limbs. Half of right lower limb was received separately along with the body from the junction of lower 1/3rd of right thigh and below that area. The exposed fractured femur was charred and also showed exposed charred muscles, tendons and the bones. Also received along with the body a black colour metallic rusted circular plate which was found over the chest and had electric circuit present over the back of the plate. The head and face were distorted and deformed. Dried blood

secretions were present over mouth and nostril over the left side. Both the upper limbs were in flexed contracted state at all the joints which included both the elbow joints, wrists, knuckles and fingers. Knees were also in flexed state with both the feet in plantar flexion and curled toes.

Right and left upper limbs were charred over the dorsomedial aspect exposing the charred underneath muscles, tendons and joints. Superficial to deep burns were present over rest of forearms and hands. There were superficial burns present over the upper back whereas superficial to deep burns present over the lower back. Both buttocks showed deep charring and exposing underneath cooked up muscles. The anterior aspect of the middle, lower abdominal area, pelvic region along with external genitalia, and both lower limbs showed superficial to deep charring with exposed muscles, tendons and bones burnt. Left knee joint was exposed with distal end of the femur, patella and proximal end of the tibia charred. The distal end of the right femur was exposed and charred. External genitalia were charred and only burnt remnant stump of the penis was left. Total body surface area of burn over the body was about 80 to 85 percentage.



Following injuries were found over the body of deceased.

- A horizontally placed lacerated wound of size 2cmx0.5cmx skin deep was present over the lateral end of right eyebrow.
- Lacerated wound of size 1.5cmx1cmx skin deep present lateral to right eye which was situated 1cm lateral to right can thus.
- A reddish contusion of size 11cmx10cm present over right side of forehead, periorbital region including right maxillary region which was situated 1cm lateral to midline, 5cm anterior to right ear auricle and 6cm above right angle of the mouth.



Scalp and Skull were deformed over the frontal and both parietal regions, on dissection the subscalpal hematoma was seen over right frontal and vertex region. On further dissection comminuted depressed fracture of skull was seen over the both frontal and parietal regions along with base of the skull. The skull was fractured into multiple bony fragments which were lacerating the dura and embedded in brain tissue. The fractured ends showed bloody infiltration in their bony trabeculae. Face over the nose and the right maxillary region was deformed, on dissection underlying tissues were found echymosed. On further dissection right side of the maxillary bone and nasal bones were found

fractured. The fractured ends showed bloody infiltration in their bony trabeculae.

Internally, Brain softened into greyish hemorrhagic pulpy mass with diffuse subdural and subarachnoid hemorrhage present at places. Lungs were soft, flabby and pale. Heart was softened and flabby. Coronary Arteries & Large Blood Vessel showed early changes of putrefaction. Liver and Gall Bladder were pale, softened, flabby. Spleen was pale, softened, pulpy. Pancreas was putrefied and soft. Both Kidney were Pale, softened

3. Discussion

Explosive-related deaths fall into 3 types: accident, homicide, and suicide. Accidental deaths normally occur either at the workplace or with untrained unlicensed individual shandling potentially dangerous equipment. The postmortem examination is critical to the investigation of explosive-related deaths. An explosive related death offers several unique issues for the forensic pathologist. First, the positive identification of the victim. Those that suffer traumatic explosive injuries to the face may make identification problematic. If visual identification is not possible, positive identification must rely on other methods of identification, such as fingerprints, dental impressions, tattoos, medical implants, or DNA. Once identity has been determined, the victim's body must be examined for physical evidence. Physical evidence includes fragments of explosive material embedded in the victim and the clothing. (4)

Abrasions, lacerations, bruises, fractures, penetrating injuries, all especially over bony prominences where the skin is less mobile are the injuries encounter commonly in a blast case [5,6]. The pattern, distribution and consequences of explosion injuries vary greatly with the nature of the explosive material [7-9]. In the present case we found some of above mentioned injuries.

Laceration (penetrating injury) over the lateral end of right eyebrow. A reddish contusion over right side of forehead, per orbital region including right maxillary region. Comminuted depressed fracture of skull was seen over the both frontal and parietal regions along with base of the skull. The skull was fractured into multiple bony fragments which were lacerating the dura and embedded in brain tissue. Right side of the maxillary bone and nasal bones were found fractured. Other injuries found in the body like multiple contusions and singeing of scalp hair are also typically found in a blast injury case.

Babar et al showed in their study on ocular trauma that 20% of the ocular trauma was caused by gas cylinder and automobile battery explosives [10]. But we did not found any ocular injury in the present case. The majority of the injuries were present on the front side of the body. This suggests that the victim must be standing close to the oven. One of the characteristic features of blast injury is body stippling with the triad of injuries - bruising, abrasions and lacerations which were distinct in this case.

4. Conclusion

In this case of blast injury, the traumatic amputation of limbs was considered to be the primary blast injuries. The multiple abrasions and lacerations were considered to be the secondary blast injuries due to fragments or shrapnel or missiles. The scalp contusion and fractures were considered to be the tertiary blast injury. After going through the details of the case and classical findings of an oven blast injury case we came to the conclusion that the death was due to shock as a result of craniocerebral damage and traumatic amputation.

We have presented this autopsy-based investigation to provide further insight into blast injuries, which are rare events. Autopsy surgeons need to have knowledge of all the types of blast injuries to help in the reconstruction of the crime scene and evaluate the cause of injuries. Physicians and surgeons need to have a basic understanding of the patho-physiology of such injuries, because the major prognostic factor for favorable outcome is accessible and timely medical and surgical treatment along with implementations of preventable occupational measures for safety.

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