Case Study

A Typical Non-ballistic Penetrating Missile Injury in an Industrial Setup: Rare Case Reports

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Abstract

Non-ballistic fatal penetrating missile injuries are rare occurrences in an industrial setup. We present two cases wherein industrial workers sustained fatal penetrating injuries while working in a steel sheet pressing factory. In the first case, a metallic piece detached from a steel sheet penetrated the chest cavity. Similarly, in the second case, a detached steel piece penetrated the left side back of the abdomen. Both the cases were brought to PGIMER, Chandigarh, a tertiary care institute for specialized care, but succumbed to their injuries. Since the injuries on the chest and abdomen were penetrating wounds which raised suspicion of foul play among relatives, both the cases were subjected to forensic autopsy. It was concluded that in both cases, the cause of death was haemorrhagic shock due to accidental penetrating injury by a detached metal piece at the workplace. Authors observed that such bizarre injuries would be easily preventable if torso armour had been made mandatory by the authorities for the workers in such factories.

Keywords: Penetrating wound, industrial injury, non-ballistic missiles, steel piece, autopsy.

Introduction

It is a well-known fact that non-adherence to safety protocols could easily result in fatal accidents in an industrial setup. According to a WHO report on global health risk published during the year 2022, more than 360,000 fatalities happen worldwide due to unintentional occupational injuries every year. Among these, more than 90% of fatalities occur in the male population, and a considerable number of them are in the age group of 15 to 59 years.[1] In India, as most of these young men are the breadwinners of their families, these occupational injuries impose a severe socioeconomic burden on the country.[2] Here we present two cases of a similar kind wherein a broken piece from a metallic sheet acted as a flying missile during cutting and processing by high-

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powered moulding machines and resulted in fatal penetrating wounds to the workers.

Case 1

A 32-year-old male was referred from a local hospital to PGIMER, Chandigarh, with an alleged history of accidental injury to the chest while working on a moulding machine in a factory situated at Yamuna Nagar district in the Indian state of Haryana. The patient was declared dead on arrival. This case, as an unnatural death, was subjected to a forensic autopsy.

Autopsy Findings

A horizontally placed stitched wound of 6 cm was found on the front of the upper chest in the midline [FIGURE 1A]. On exploration, wound margins were clean cut with both angles being acute. The penetrating injury extended into the chest cavity through the sternum, at the level of the third intercostal space. The wound track was further extending into the left lung, making an entry defect of 2.5 cm x 1.3 cm on the costal surface of the upper lobe[FIGURE 1B]. A metallic piece of 5 g was found embedded in the lung tissue measuring 6.5 cm x 1.8 cm with sharp margins [FIGURE 1C]. About 1.3 litres of fluid and clotted blood were found in the left pleural cavity. All the internal organs were found pale. The cause of death was declared as hemorrhagic shock.

Figure 1A: shows a penetrating wound on the chest wall, Figure 1B: shows a penetrating wound in the upper lobe of the left lung, Figure1C: shows the metal sheet piece of 6.5 cm x1.8 cm.

Case 2

A 22-year-old male was admitted to the emergency department of PGIMER, Chandigarh with an alleged history of injury on his back by shrapnel at his workplace in a steel plant at Jagadhari in the State of Haryana, India. The patient was first taken to a local hospital where his ultrasound abdomen showed a 4.4 cm x 3.2 cm ill-defined cystic lesion near the medial pole of the left kidney suggestive of hematoma, thereafter the patient was referred to our hospital on the same day. On admission, the patient was unconscious and in respiratory distress with a Glasgow coma scale (GCS) score of 4. A penetrating injury was noted over the back near the midline at the level of T11 and T12. Ultrasound showed moderate right-sided pleural effusion and mild left-sided pleural effusion with retroperitoneal hematoma and rupture of psoas muscles on the right side. Hedied within 24 hours of admission. As it was amedico-legal case,a forensic autopsy was conducted by the Department of Forensic Medicine.

Autopsy findings

A stitched penetrating wound of 1.1 cm was found over the back of the left side of the abdomen, near the midline at the level of the eleventh thoracic vertebra.[FIGURE2 A] The wound extended into the peritoneal cavity by penetrating the diaphragm, psoas muscle, the hilar surface of the spleen, and the upper pole of the left kidney and got lodged in the caudate lobe of the liver.[FIGURE2B] A thin metallic object weighing 1 g measuring 4 cm x 0.5 cm was retrieved from the liver.[FIGURE 2C] The peritoneal cavity was full of fluid and clotted blood of about 1.5 litres. The cause of death was declared as haemorrhagic shock.

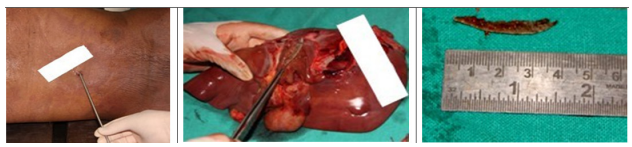

Figure 2A: Probe showing penetrating wound over the back, Figure 2B: Pointer showing the metallic piece in caudate lobe of the liver, Figure 2C: showingthe metal piece of 4cm x 0.5 cm.

Discussion

Penetrating injuries due to flying objects or missiles are widely reported in the literature mainly seen in gunshot or bomb blast cases.[3] Non-ballistic missile injuries are very rare and when they happen in an industrial setup without any eyewitness, raise suspicion about the homicidal nature of such injuries.

In the first case, the deceased was working in a steel factory where he was cutting steel sheets, a metallic piece from the steel plate got detached and hit the chest. It penetrated the lung and resulted in haemothorax. Similarly, in the second

case, when the deceased was working with a steel sheet pressing machine, a detached piece acted as a missile that penetrated the liver and resulted in a haemoperitoneum. Both cases were from the same industrial zone, which suggests the common occurrence of such injuries in that area.

Such kind of penetrating injuries are characterized as non-ballistic missile injuries in which the injuries are caused by an object with an impact velocity of less than 100m/s.[4] Various studies suggested that for a missile to perforate the skin, subcutaneous tissue and underlying muscle, a minimum velocity of 70 m/s is needed.[5,6,7] The tissue damage depends upon the kinetic energy of the missile and the density of body tissue penetrated. The specific gravity of tissue determines the amount of damage caused by penetrating missiles.[8,9] Dense organs absorb more energy resulting in more damage. Lungs have much lower density as compared to the liver.[9]

Only a few such types of penetrating occupational trauma caused by non-ballistic missiles are reported in the literature. Corzani et al. reported a case where a 22-year male encountered occupational injuries while making firewood with an axe, a detached metal piece from the axe penetrated the neck, pleural cavity, and upper lobe of the left lung and lodged in the posterior thoracic wall resulted in hemopneumothorax.[10]Satyarthee et al. reported a case of a 28-year male construction worker, who sustained a penetrating injury from a triangular piece of knife-sharpening ceramic stone which got detached from the machine penetrated his right orbital roof and got lodged in the right parietal lobe of the brain.[11] Such kind of cases are measurably reported from developing and underdeveloped nations due to poor implementation of safety guidelines at workplaces. In developed nations, such types of occupational hazards are minimized by industrial automation and strict implementation of safety guidelines. To prevent such factory-related injuries, the state government should arrange regular training programs regarding safety measures for handling machine parts. Government officials should visit factories regularly and ensure that there is no violation of prescribed standards.

Conclusion

These cases confirm the fact that improper industrial setups and flouting of safety rules may result in fatal penetrating injuries. Despite the rules regarding safety and quality norms in factories, the availability of high-quality industrial machines is rare. The government should take strict regulatory action towards the factories flouting safety norms and not adhering to a regular check-up of machines. The fatalities in the present cases could have been easily avoided, had the workers been provided protective torso jackets. Regular updating, as well as training among workers, could pave the way for a better and more protective Industrial working environment.

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