Injuries Due to Improvised Explosive Devices

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Abstract
Illegal possession of improvised explosive devices (IEDs) is not uncommon. In Sri Lanka, they are commonly used for hunting, protecting cultivation, etc. Further, they are also used to commit homicides. An IED called "Hakka Patas" is produced by the material available in firecrackers and causes pressure-sensitive blasts. Another IED "Ali Wedi", a kind of larger firecracker, may cause accidental injuries. However, the injuries caused by "Hakka Patas" and "Ali Wedi" are not reported in the forensic literature.

Case 1: A child received severe crush injuries of the foot following a "Hakka Patas" explosion while walking. The wound was grossly contaminated and on the second day, a below knee amputation was done. Case 2: A farmer received injuries to his right hand while he was throwing an "Ali Wedi". Due to gross crush injuries, the right index finger was amputated.

Strict rules and regulations should be implemented to control illegal, locally-made explosive devices to prevent morbidity and mortality. Forensic pathologists should be familiar with the atypical patterns of injuries produced by improvised explosive devices.

Keywords: Improvised explosive devices, amputation, homicide, accidents

Received: 20 July 2023, **Revised version accepted:** 18 Dec 2023, **Published**: 31 Dec 2023 ***Corresponding author:**
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Cite this article as: Munasinghe KR, Vidanapathirana M, Rascon MA. Identification of the Vehicle of a Hit-and-Run Accident Based on Patterned Evidence. Medico-Legal Journal of Sri Lanka, 2023;11(2):25-28.

DOI: https://doi.org/10.4038/mljsl.v11i2.7486

Introduction

Illegal possession of improvised explosive devices (IED) is not uncommon. In Boston Marathon, On 15th of April 2013, two improvised explosive devices were detonated, killing three people and injuring 264 others.[1] Moreover, civilians, who are unprotected from blast exposure, can be severely harmed by terrorist attacks that use improvised explosive devices (IEDs).[2]

In Sri Lanka, IEDs are commonly used for hunting, protecting cultivations, etc. Further, they are also used to commit homicides. An IED called "Hakka Patas" is produced by the material that are available in firecrackers and causes pressure-sensitive blasts. Another IED "Ali Wedi", a larger firecracker, may cause accidental injuries. The injuries caused by "Hakka Patas" and "Ali Wedi" are not reported in forensic literature. The following case discussions elaborate the medicolegal issues and injury patterns of such locally made improvised explosive devices.

Case report

Case 1: A 15-year-old child received severe crush injuries of her right foot when she stepped on the ground while walking along a jungle in Ratnapura with her parents. She was rushed to the tertiary care hospital of the area and the wound was found to be grossly contaminated and the X-rays showed few irregular radio-opaque foreign bodies (Figure 1). On the second day, a below-knee amputation was performed by the surgeon (Figure 2). According to the relatives, the injuries were alleged to have been caused by a "Hakka Patas" explosion that had been planted on the ground to kill small and medium sized wild animals.

Figure 01. Crush injuries to foot with foreign bodies


Figure 02. Amputated foot

Case 2: A farmer received injuries to his right hand while throwing an "Ali Wedi" (Elephant cracker) to chase away elephants. He was rushed to the nearest tertiary care hospital and found to be having localized crush injuries to the right index finger. However, due to gross crush injuries, the surgeon amputated the distal phalanx of the right index finger (Figure 3).


Figure 03. Amputated right index finger

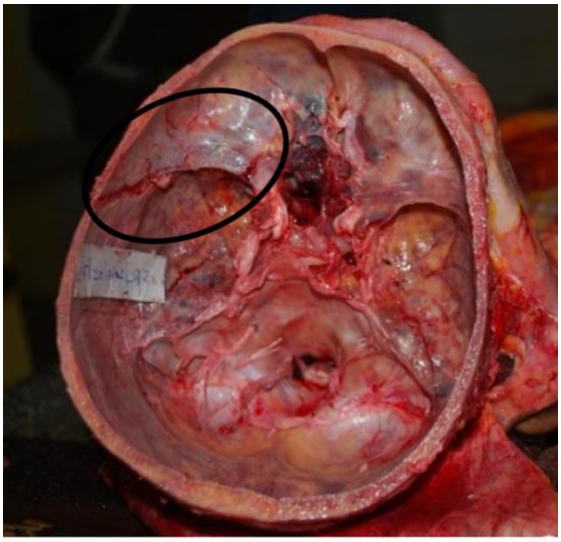
Figure 04. The base of the skull shows the left basal skull fracture indicated by black circle.

Discussion

Explosives can be classified into three groups. (a) Materials that detonate are said to be "high explosives" such as dynamite, RDX, etc. (b) Materials that deflagrate are said to be "low explosives" such as gunpowder and potassium nitrate. (c) Materials that can be initiated by a relatively small amount of heat or pressure are primary explosives such as potassium chlorate, arsenic sulphide, etc. (4). "Hakka Patas" and "Ali Wedi" are made up of the explosives of the crackers and are sensitive for heat and pressure. Therefore, the type of explosive contained in such IEDs can be classified as primary explosives.

In Sri Lanka, improvised explosive devices (IEDs) such as "Hakka Patas" are locally made to kill small and medium-sized animals such as wild bores, deer, and sometimes to damage large animals. Hakka Patas' is usually hidden in animal fodder. Poachers mix the explosives with small stones and coat them with dried fish particles to lure animals – especially wild boar, but elephants too are often becoming unfortunate victims. "Hakka Patas" IEDs are inserted into vegetables such as pumpkins and bring about slow, painful, and inhumane death to

elephants.[3] Since they contain primary explosives such as firecracker powder, the explosion is initiated by a relatively small amount of heat or pressure. For example, when munched by small or medium-sized animals or stepped on it by heavy animals they explode. Even though they are used to kill animals, accidental injuries to humans are also not uncommon. Sometimes, they are used to commit homicides as well.

"Ali Wedi" (elephant crackers) are also a kind of IED used to chase away wild elephants but may damage property and people too. Since they contain primary explosives such as firecracker powder, the explosion is initiated by a relatively small amount of heat or pressure. For example, when the flame is applied it explodes.

Blast injuries can be classified into four types. (a) Primary blast injuries are those caused by the direct effect of overpressure on a person. (b) Secondary blast injuries are the injuries caused by the effect of projectile fragments incorporated in the bomb, like nails, rocks or scrap metal. (c) Tertiary blast injuries are caused by the effects of the blast wind, resulting in physical displacement. Most fractures, blunt trauma, and tissue contusions are tertiary blast effects. (d) quaternary blast injuries are a variety of injuries caused by burns, psychological trauma, toxic inhalation and exposure to radiation.[5] The case-1 had localized grossly contaminated injuries in the right limb and was confirmed by the presence of irregular radio-opaque foreign bodies in X-rays (Figure 1). Therefore, the findings are compatible with the injuries caused by the effect of projectile fragments incorporated in an IED, like nails, rocks, or scrap metal. Therefore, the type of blast category should be the Secondary blast injuries.

These local IEDs are made of primary explosives extracted from firecrackers. Since they contain relatively a large amount of low explosives, they have caused severe local damage with contamination. Therefore, the clinicians had to amputate the affected part of the body.

Usually, amputations are done to remove non-vital tissues and to overcome the sepsis due to contamination or as a lifesaving process. IEDs used in warfare, contain high explosives and a frequently seen injury pattern is traumatic lower limb amputation.[6] Since they are high explosives, the injuries may not confine to the impact site and demonstrate a higher incidence of pelvic fractures in patients with traumatic lower limb amputations.[6] Blast injuries, caused by high explosive explosions are accompanied by high-pressure waves, produce diffuse injuries such as tissue damage in the acute period, followed in the later period by circulatory disorders due to vascular endothelial damage and related tissue necrosis.[7] Since the cases under discussion had injuries mainly confined to the site of the blast and the amputations had not been due to the blast but had been performed by the surgeons, the explosives should be primary explosives.

Usually, local IEDs produce local crush injury with blood vessel damage, contamination and they may die due to complications of hemorrhage or infections. These local IEDs are filled with metal objects found in the locality such as nuts, bolts, bicycle balls etc. Because of low velocity, they remain inside the injury. The embedded fragment wounds containing metal and metal mixtures may cause consequences and the long-term toxicologic and carcinogenic properties are not yet known.[8,9]

The clinicians and pathologists should also be aware that there is a risk when they deal with patients injured by IEDs. Though we usually come across metal fragments from IEDs being embedded in patients, there have been instances where the partially detonated home-made explosive device (HME) had been found embedded in limbs.[10,11] Therefore, safe disposal of the IED substance should be made aware to overcome the risk to the patient, surgical team, and the pathologist.

In these cases, scene visits are important as parts of the IEDs may be available at the scene. However, in injuries due to local IED, the injury patterns are atypical. Therefore, proper records should be maintained by way of sketches, notes, photographs, and X-rays as was done in these cases.

Recovered evidence were submitted for analysis while maintaining the chain of evidence. Recovery of metal fragments and projectiles are helpful in deciding whether the IED is homemade or factory made. The direction of the metal projectiles and their pattern may be helpful to decide the direction of the blast.

Conclusions

IEDs such as "Hakka Patas" and "Ali Wedi" cause secondary blast injuries due to primary explosives. Forensic pathologists should be familiar with the atypical patterns of injuries produced by IEDs for better medico-legal interpretations and management. Strict rules and regulations should be implemented to control illegal, locally-made explosive devices to prevent morbidity and mortality.

Disclosure statement

Conflicts of interest: The author declares that she has no conflicts of interest.

Funding: None

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