

Medico-Legal Opinion Based on Autopsy Findings of a Victim of an Explosion Involving Mass Fatality

Yalini Thivaharan  and Indira Deepthi Gamage Kitulwatte

ABSTRACT

Introduction: Investigation into explosions is one of the major areas in forensic medicine and pathology. Medico legal issues associated with these deaths are diverse and forensic experts are often expected to make clarifications. Assistance of a methodical scientific investigation of such a death in evaluation of unanswered medico legal issues, of an autopsy of one of the victims of Easter Sunday explosions is discussed. **Case history:** The deceased was a 15-year-old girl who was participating in the Easter mass at St. Sebastian's Church - Kattuwapaitya, Negombo, Sri Lanka when a suicide bomber blew himself up. The mother of the deceased noticed the deceased being rushed to the hospital. However, she was pronounced dead on admission. Pre-autopsy radiology revealed spherical shrapnel in the temporal region. At autopsy, the fatal injury was found on the head and a detailed study revealed skull fractures associated with penetration by 3 shrapnels. There was a keyhole lesion among the penetrations. Internal examination revealed an extensive dural tear underlying the compound fracture. The brain was grossly edematous with lacerations on the frontal and parietal lobes associated with localized subarachnoid hemorrhage. There were multiple underlying contusions on bilateral frontal white matter. Small subarachnoid haemorrhage was noted on the basal aspect of the brain. **Discussion:** Careful evaluation of the autopsy findings assisted in formulating the opinion scientifically on event reconstruction including the proximity of the victim to the epicenter of explosion and nature of explosive device, period of survival, mechanism of causation of skull fractures and the mechanism of death in addition to the cause of death. **Conclusion:** A forensic pathologist following a meticulous autopsy examination, along with a team of ballistic experts and specially trained police personnel play a pivotal task in analyzing a scene of explosion and an autopsy of a victim, in concluding the case and in bringing justice to all the victims and survivors of the catastrophe.

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AVAILABILITY OF DATA AND MATERIAL

No objections in sharing data.

AUTHORS' NOTE

This manuscript has not been submitted to any other journals, and is the original work of the authors and has not been published elsewhere.

ETHICAL APPROVAL

This case report is about an autopsy examination in one of the victims of the Easter Sunday Suicide Bombings that shook the island of Sri Lanka. The autopsy was conducted under the Magistrate order. No tissues or organs were retained.

STATEMENT OF HUMAN AND ANIMAL RIGHTS

No human or animal rights have been violated. No tissues or organs have been retained.

DISCLOSURES & DECLARATION OF CONFLICTS OF INTEREST

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INFORMATION

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INTRODUCTION

Investigation into explosions is one of a major area in forensic medicine and pathology. Direct or indirect exposure to a blast can cause serious injuries. Medico legal issues associated with these deaths are diverse and forensic experts are often expected to make clarifications.

Terrorism is an illegal act of violence, which does not consider the physical and emotional safety of civilians and often generates an unexplained fear for their beliefs (1). Terrorism not only causes physical or structural injuries, but it casts an immense harm to the psychological, economical, social and cultural segments of a society (2).

With the reemergence of terrorism in this country, it has yet again become essential that all relevant authorities keep vigil to handle a sudden catastrophic event. When a forensic expert visits a crime scene of explosion, especially that is related to terrorism, he is expected to possess a basic knowledge of the explosives, the patterns of explosion, and the pattern of damage cast upon due to the various factors of explosion (3,4).

A meticulous analysis and exploration of a scene of explosions aids the involved authorities to unearth all the concealed facts of the unfortunate event. The evidence recovered during the scene examination and the analytical processing following an autopsy of a victim of explosion provides great assistance in timely provision of justice. Merely for this basis, it is absolutely vital that the collection and interpretation of scientific facts are conducted in a professional manner to accomplish successful results.

Establishment of the accurate anatomical locus in a victim of suicidal bomb attacks are regular and symmetrical, but no such patterns are preserved in accidental blasts and terrorist attacks. The injury pattern shows a wide range of variation in such cases. But in terrorist attacks, involving the same type of terrorist group and same type of explosive, it has been evident from the

previous studies carried out that the associated deaths had many common features and patterns of injuries, in comparison to other death cases (5).

Blast injuries are predominantly classified as primary, secondary, tertiary, and quaternary injuries. The foremost injuries are due to the blast waves, mainly affecting the bodily structures with gaseous interface, such as the ear drums, lungs, and bowels. Interestingly despite previous beliefs, rupture of tympanic membranes are considered as a poor predictor of blast injuries in the current days (6). Secondary injuries are due to the projectile debris, while the tertiary damages are a result of blast wind or collapsing of masonry. The latter classified injury pattern are expected to cover all the remaining types of injuries. But an expert who is handling a case of explosion should bear in mind that different bodily systems respond to such traumatic events in different manners and they should be managed with a diverse approach. Assistance of a methodical scientific investigation of such a death in evaluation of unanswered medico legal issues is discussed.

CASE

The deceased was a 15-year-old girl who was participating in the Easter mass at St. Sebastian's Church—Katuwapitya, Negombo—when a suicide bomber entered the church and blew himself up, killing over hundred and injuring and permanently disabling many more. Following the explosion, the mother of the deceased noticed the deceased being rushed to the hospital in a car. However, she was pronounced dead on admission.

Pre autopsy radiology revealed spherical shrapnel in the temporal region (Figure 12). The injuries that are of value in analyzing the injury pattern and those that will help to reconstruct the event are described below, very briefly. The exact dimensions and accurate anatomical locations are not being described.

There was a large irregular and deep laceration on the front of the head (**Figure 1**), with its midpoint roughly 7 cm above the glabella and another deep and irregular



Figure 1: Large irregular and deep laceration on the front of the head.



Figure 3: Compound fractures under each laceration.



Figure 2: Deep and irregular laceration on the left side of the top of the head.



Figure 4: Some of the fragments were not in place in the reconstruction of skull cap.

laceration was observed on the left side of the top of the head (**Figure 2**). The surfaces of the scalp beneath these injuries were severely contused. Under each of these lacerations were compound fractures (**Figure 3**). Upon reconstruction of the skull cap, some of the fragments were not in place (**Figure 4**). Few fragments were embedded in the brain parenchyma. The skull bone between the abovementioned compound fractures were also fragmented, therefore for convenience these two fractures are considered as one whole compound fracture. Inner beveling was noticed from 4 o' clock to 7 o' clock position and outer beveling was noticed from 12 o' clock to 2 o' clock position giving rise to a keyhole lesion. There were radiating fractures

from 12 o' clock, 5 o' clock, 7 o' clock, 8 o' clock, and 10 o' clock positions. The fracture radiating from the 7 o' clock position ran downward and inward into the right orbit and toward the base of skull and extending from the anterior cranial fossa to the middle cranial fossa, incorporating the sphenoid bone, ethmoid bone, and sella turcica (**Figure 5**). The coronal suture intersecting the compound fracture showed features of sutural diastasis.

Internal examination revealed an extensive dural tear underlying the compound fracture. Upon reflection of

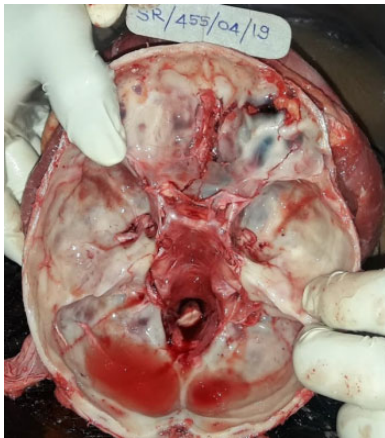


Figure 5: Radiating fractures extending to the base of skull, from the anterior cranial fossa to the middle cranial fossa, incorporating the sphenoid bone, ethmoid bone, and sella turcica.



Figure 6: A shrapnel found lodged in the mid aspect of its origin—in the rim of the temporal fossa of the skull.

the right temporalis muscle, a shrapnel (metal ball measuring 0.5 cm in diameter) was found lodged in the mid aspect of its origin—in the rim of the temporal fossa of the skull (**Figures 6 and 7**). The brain was grossly edematous with brain parenchyma showing lacerations on the frontal and parietal lobes (**Figure 8**). There were multiple underlying contusions on bilateral frontal white matter (**Figure 9**). The brain laceration was associated with localized subarachnoid hemorrhage (**Figure 10**). Small subarachnoid hemorrhage was noted on the basal aspect of the brain.

A penetrating irregular laceration was found running diagonally on the right ear, involving the triangular fossa (**Figure 11**).



Figure 7: A shrapnel (metal ball measuring 0.5 cm in diameter).



Figure 8: Brain parenchyma showing lacerations on the frontal and parietal lobes.

There were small lacerations and abrasions found on the upper and lower extremities, cheeks, and the tip of the nose.

DISCUSSION

Careful evaluation of the autopsy findings assisted in formulating the opinion scientifically on event reconstruction including the proximity of the victim to the epicenter of explosion and nature of explosive device, period of survival, mechanism of causation of skull fractures, and the mechanism of death in addition to the cause of death.

At autopsy, the fatal injury to the deceased was found on the head. The torso, upper, and lower extremities

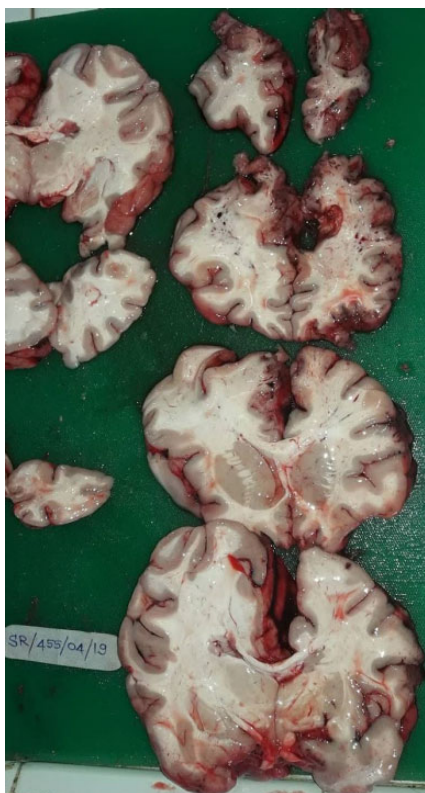


Figure 9: Multiple underlying contusions on bilateral frontal white matter.



Figure 10: Brain laceration was associated with localized subarachnoid hemorrhage.

were spared of any serious injuries. The few abrasions noted on the extremities are highly likely to have been caused by falling masonry or friction with surrounding objects, during or soon after the explosion and are nongrievous in nature.



Figure 11: Penetrating irregular laceration, running diagonally on the right ear, involving the triangular fossa.



Figure 12: Preautopsy skull X-ray revealing a spherical shrapnel in the right temporal region.

A detailed study of the skull fractures shows that penetration by three shrapnels is a high likelihood. The injury on the front and middle of the skull represents a “keyhole lesion” found in atypical gunshot injuries (7). It occurs when the bullet enters and exits from the same defect, and the defect will contain features of both entry and exit wounds. This same phenomenon could be applied to the penetrating shrapnel in this case.

Studying the beveling patterns of the extensive compound fractures are suggestive that once shrapnel entered and exited through the defect in the front and another shrapnel entering through the defect in the

front and exiting through the defect toward the top of the head.

The metal ball found lodged right temporalis muscle—in the rim of the temporal fossa of the skull—is likely to have penetrated through the laceration of the right side of the scalp. Due to the impact at a shallow angle and travel between the scalp and the skull, the shrapnel could have lost its energy to travel, and would have come to rest at the relatively tough area of the origin of the temporalis muscle.

Therefore, it is likely that three shrapnels were involved in creating the abovementioned injuries, out of which one was retrieved during the autopsy. Fragmentation of the skull bones could have been caused by the force of the shrapnel, striking the outer table which can dislodge a segment of bone which is pressed upward as the shrapnel travels underneath.

Due to the cranium being a closed pressure and volume system, the radial distribution of forces creating cavity expansion found in other tissues is restricted. This restriction does not decrease the amount of trauma but rather causes curvilinear displacement of the cavity forming forces on the tissue with significant strain on brain matter. The shearing force of the volume restricted cavitating energy coupled with bone fragments serving as secondary missiles make damage potentially devastating in nature (8). This feature indicates high velocity of the projectile.

Subarachnoid hemorrhage is bleeding into the subarachnoid space—the area between the arachnoid membrane and the pia mater surrounding the brain. There are quite a number of postulated mechanisms of death due to subarachnoid hemorrhage (9). Out of which the more apt ones to this particular case is blood mixing with the cerebrospinal fluid, bathes over the spinal cord, causing spinal cord irritation, which hinders with the functions of the vital centers, leading to almost rapid death—this is also a possible mechanism of death, in this particular case. However, in this case, the brain lacerations play a crucial role in causing the death than the subarachnoid hemorrhage.

Injuries acquired by the deceased are very lethal, and even with optimum medical care and interventions, her survival is very minimal. And even if she survives, it would be in a prolonged vegetative state, with extremely poor quality of life.

The fatal injuries, which are likely to be due to the direct impact by the shrapnels discharged from the explosion, are confined to the head of the deceased. This could be explained by the relative short stature and the relatively close position of the deceased, in relation to the bomber. And the injury pattern is compatible with the claimed sitting position of the deceased, at the time of the explosion.

Considering all the above explanations, it is concluded that the causes of death was due to craniocerebral injuries due to shrapnels discharged from an explosion. The period of survival could be narrowed down to few minutes, considering the lethality of her injuries.

CONCLUSION

Usually, identification of mutilated body from an explosion is a frequent challenge a forensic pathologist faces. But in this particular case, due to the relative preservation of the facial features and from the clothing and personal effects, it was not a cumbersome process.

It is evident that a forensic pathologist along with a team of ballistic experts and specially trained police personnel play a pivotal task in analyzing a scene of explosion and an autopsy of a victim, in concluding the case and in bringing justice to all the victims and survivors of the catastrophe.

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