## E66 Computed Tomography (CT) Scans and Autopsy Results of Nine Civilian Casualties of a Terrorist Attack

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**Learning Overview:** The goal of the presentation is to offer an overview of the injuries that can be found in victims of terrorist attacks and to explain how to integrate the autoptic data, the information given by multi-planar reconstruction, and 3D volume-rendering techniques.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by exposing the wide spectrum of features that can be found at the imaging and autopsy stages and demonstrating the importance of performing CT scans in order to provide accurate/full forensic autopsies in terrorist attack cases.

Prior to the rise of domestic terrorism, in many Western countries, pathologists experience of injuries caused by bombs and other particular types of unusual weapons, such as swords and unusual firearms, was limited to war casualties. In an Asian country, nine tourists were killed during a terrorist raid in a restaurant. The group used pipe bombs, machetes, and various types of firearms (handguns, submachine guns, and AK-47 assault rifles) loaded with illegal bullets. Local pathologists performed full forensic autopsies on the bodies. CT scans and new autopsies were performed on all nine victims. For the postmortem radiologic investigation, two techniques (multi-planar reconstruction and 3D volume-rendering) were used, obtaining both 2D images and 3D reconstructions. The first two cases presented slash wounds of the head and neck inflicted by machetes, while in the last seven cases, gunshot wounds were found (in two cases associated with injuries caused by explosive devices).

The terrorists used firearms that shot at different velocities: handguns, submachine guns, and AK-47s..One of the most important ballistic characteristics was the fact that prohibited ammunition (expansion or hollow point bullets and fragmenting bullets) were used. Expansion bullets are also called “hollow point,” because they collapse upon impact with hard surfaces such as bone, which increases and expands the kinetic energy transfer. Fragmenting bullets break into several pieces, which exponentially increases the injury area.

In general, CT is considered particularly useful in the imaging of terrorist attack victims, since it is highly sensitive in detecting firearm and blast injuries (in particular, fractures), and it can reliably detect glass or metallic fragments. In these cases, CT scans proved to be very useful to reconstruct the bullet track, revealing the bone and metal fragments deposited during cavitation. Moreover, in many of the described cases, death was caused by headshots. CT scans were able to identify entrance holes in the skulls (characterized by the typical conic shape). Moreover, in two cases, CT scans revealed miscellaneous objects identified as low-energy shrapnel released by Improvised Explosive Devices (IEDs). Shrapnel is oftentimes added to IEDs by terrorists to increase their destructive potential. Terrorists also consider location of the attack to enhance severity. In confined spaces, the energy released by explosions can be increased four-fold to eight-fold.

In conclusion, as demonstrated in these cases, casualties of terrorist attacks exhibit a huge spectrum of injuries whose characteristics are relatively unusual for those who practice forensic pathology in Europe. In victims presenting explosives or firearms injuries, multi-planar reconstruction and 3D volume-rendering proved to be highly valuable to understand the types of weapons used and the dynamics of the attack.

**Terrorism, Military Weapons, Postmortem Imaging**