

belonging to men suddenly missed in the nineties, suspected as victims of the local criminal organization. The gravine is now famous with the name of cemetery of the Gargano's mafia.

Skeletal Remains, Ravine, Homicide

## G95 Use of Multidetector Computed Tomography (MDCT) in the Evaluation of Gunshot Wounds

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After attending this presentation, attendees will understand the process used by the Armed Forces Medical Examiner System (AFMES) to integrate MDCT into the evaluation of gunshot wounds. Attendees will be able to describe the advantages and limitations of utilizing MDCT in the evaluation of gunshot wounds.

This presentation will impact the forensic science community by detailing a novel approach to overcome the limitation of the visualizing entrance and exit gunshot wounds with MDCT.

Postmortem forensic imaging is a critical tool in the evaluation of gunshot wounds. Traditionally, fluoroscopy and digital/plan film x-rays have been utilized to document and locate bullets and bullet fragments in cases of gunshot wounds. In the last several years, traditional imaging techniques in conjunction with postmortem MDCT has made it possible to obtain precise three-dimensional localization of bullets and bullet fragments. In addition, this technique has been shown to be an effective method for aiding in the documentation of gunshot wound paths and evaluation of internal organ injury prior to autopsy.

One of the main limitations of utilizing MDCT in the evaluation of gunshot wound paths is the inability of MDCT to precisely locate the surface entry and exit wounds. Although the presence of gas in the soft tissue and disruption of tissue surfaces may be helpful in the precise location of these wounds, the collapse of the temporary cavities, compression of soft tissue defects and the position of the of the body on the scanning table can limit the detection of the entry and exit wounds.

In order to overcome this limitation, a novel technique was developed utilizing radio-opaque markers. Briefly, the body is first imaged by digital x-rays to identify any bullets or bullet fragments in the body or clothing. Next, digital photographs of the body and gunshot wounds are taken and the locations of the gunshot wounds are marked with a 1.5 millimeter radiopaque marker. The body is then imaged with MDCT. The resulting images are processed with imaging software to produce a three-dimensional image of the body with the precise location of the entry and exit wounds on the skin surface. Reconstructed images are manipulated to obtain any desired orientation of the body and wound pathway. These images can then be used to demonstrate the gunshot wound pathways in medicolegal proceedings. It must be noted that this technique does not overcome the limitation of MDCT in distinguishing entrance gunshot wounds from exit gunshot wounds. This distinction is made by combining the postmortem forensic imaging with the findings from the external inspection and internal dissection of the body.

Computed Tomography, Gunshot Wounds, Virtual Autopsy

## G96 Gunshot Wounds Covered by Different Textiles: Determination of GSR Through Micro-CT Analysis

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After attending this presentation, attendees will have novel information on the role of Micro-CT analysis of gunshot wounds for estimating the firing range.

This presentation will impact the forensic science community by adding new data on the estimation of the firing distance of intermediate-range gunshot wounds in clothed victims, through a micro-CT analysis of the gunshot residue.

Estimation of the firing range is often critical for reconstructing gunshot fatalities, where the main measurable evidence consists of the gunshot residue (GSR). Several techniques and methods have already been used for characterizing GSR, such as Atomic Absorption Spectroscopy, Neutron Activation Analysis, Autoradiography, Routine-CT, Scanning Electron Microscopy, and Histochemistry. Recently, a novel approach, based on the use of Micro-CT, proved to be an objective, reliable, rapid, and inexpensive tool for estimating the firing range in intermediate-range shots.

**Aim of the Study:** It is well known that the presence of clothes covering the body heavily affects the distribution of GSR on the entrance wound, hindering the estimation of the firing range on the basis of the sole macroscopic inspection.

The goal of the present study was to evaluate the differential distribution of GSR, with regard to the different kinds of textiles covering the skin, by means of micro-CT analysis, with the final purpose of reconstructing the firing distance.

**Materials and methods:** Human legs, surgically amputated, were cleaned of dried blood and any other contaminants, and cut into sections of approximately 6 cm in length.

A total of 60 sections were selected; each section was covered with a single type of textile, chosen among cotton fabric (n = 15), jeans (n = 15), leather (n = 15), and waterproof synthetic fabric (n = 15). Bare skin sections were used as controls (n = 15).

Firing was carried out perpendicularly at distances of 5, 15, and 30 cm, using a .32 pistol loaded with full-jacketed bullets. A total of 75 shots were performed (five replicates for each distance). After each firing test, the gunshot wounds were photographed and formalin fixed.

The skin specimens, comprising the epidermis, dermis, and subcutaneous fat, were cut into parallelepipeds (height 1 cm, side 1 cm) with a lancet. Samples were scanned following standard processing procedures, using a high resolution scanner.

The acquired raw data were reconstructed with reconciliation software, which uses the back-projection algorithm to reconstruct axial subsequent images saved as bitmap format. The bitmap images were analyzed by a CT analysis software: the selected volume of interest (VOI side of 1 cm and height of 3.8 mm) was focused in the centre of the specimen in order to have the entire entry wound positioned in the middle. All the samples were binarized using the same parameters.

The percentage of GSR deposit was calculated analyzing all particles with a density higher than 1000 Hu (particles with a density lower than 1000 Hu were excluded to reduce iron artefacts). The 3D images were reconstructed through a Ct-Vox Software.

**Results:** The visual inspection of the skin did not allow the estimation of the firing distance for the covered gunshot-wounds; the

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morphological features of the entrance wounds (blackening and tattooing) were, indeed, not discernible.

The micro-CT analysis revealed that:

- GSR particles were less represented in cases compared to controls;
- In cases GSR particles were distributed inside the cavity and the fatty tissue of the entrance wound, while in controls they were present mainly on the skin around the hole; and,
- Increasing the firing range, the radiological detection of GSR progressively decreased in both cases and controls, allowing a good discrimination of the firing distances tested in the present study.

**Conclusions:** Micro-CT analysis might be useful for the forensic assessment of the firing range, particularly when the morphological features of intermediate-range wounds are not visually discernible (i.e., black people or clothed victims).

**Forensic Pathology, Gunshot Wounds, Firing Range**

## G97 Child Abuse vs. Cachexia: Do Healing and Acute Rib Fractures Trump a Diagnosis of Probable Cardiac Dysrhythmia Due to Electrolyte Abnormalities

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After attending this presentation, attendees will gain an awareness of potential differential diagnoses between forensic anthropologists and medical examiners/coroners on child deaths becomes evident.

This presentation will impact the forensic science community by informing attendees of the difficulties that accompany medical/anthropological diagnoses of child abuse, and the complications that arise when specialists attempt to contribute to cause and manner of death in infants.

One of the most difficult tasks confronted by forensic pathologists is the determination of cause and manner of death in suspected child abuse cases. In the last 15 years, forensic anthropology has demonstrated a potential for contributing to the cause of death, by systematically examining questionable skeletal areas after processing the skeletal elements free of soft tissue for a close look. Certainly, an accurate analysis of acute and healing fractures contributes immensely to a final diagnosis of infant's deaths. But do the two professions, with different approaches and diverse responsibilities, ever conflict in diagnoses? Of course they do. Below is a case where such a conflict arises.

An unembalmed body of a well developed, poorly-nourished female was examined and autopsied. The body appears younger than the reported three-months. Inanition is evidenced. The pale skin shows no acute injuries, or scars, nor were there any indications of trauma from the external exam. A V-shaped incision was performed previously by a tissue harvest team to remove the heart and proximal aorta. The clavicle and first rib on the right side were sectioned for this procedure. The first indication of skeletal injuries is first discovered during the internal examination of the ribs, where hemorrhage, acute, and possible healing rib fractures are visible.

Pathologic diagnoses documents small body size, where height and weight are diagnosed as in the 3<sup>rd</sup> percentile for age. Morgue examination weight is 7 lbs 6 oz, where birth weight was 6 lbs 3 oz. This presents neglect or failure to thrive. Also noticed is documented dehydration and small organ weights. Finally, blunt force skeletal injuries are present, with acute, chronic, and acute-on-chronic rib fractures. History indicates that aunt called 911 at 15:30 after last seeing the child alive at 8:30 that morning. The aunt is the legal guardian.

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The anthropologist was called in at the first recognition of skeletal trauma. At that point it was decided to remove all ribs, both clavicles, and vertebrae C-7 through L-4 after extensive photographic documentation. These were processed free of obvious soft tissue, but preserved in anatomical position to give a better idea of three dimensional relationships of the complicated trauma to bone.

Dry bone examination combined with faxitron radiographs indicate numerous rib fractures as listed in Table 1.

Table 1. Summary of rib fractures in 3-month-old infant.

<b>RIB FRACTURES</b>				
<b>Acute</b>	<b>Chronic</b>	<b>Stable Chronic</b>	<b>Acute On Chronic</b>	<b>Other Procedure</b>
15*	6	10 (3 questionable)	2	1 (tissue bank)

\*All rib head apex tears

As one would guess, the anthropological report documents and describes the 33 insults to bone that clearly point to non-accidental trauma, with the history as reported. However, from a medical examiner point of view, this case was everything but a clear case of child abuse.

It is ruled the death of this 3-month-old as attributed to probable cardiac dysrhythmia due to electrolyte abnormalities. Postmortem testing for calcium and vitreous sodium yielded abnormally low levels. Multiple blunt force injuries in the form of acute and chronic rib fractures were also noted at autopsy. No external signs of trauma are seen on the body. Differential diagnoses of the infant's abnormalities include natural and non-natural causes. Neglect and child abuse cannot be ruled out, however, nor can a natural cause such as a metabolic disorder be eliminated. To complicate issues, the infant had been taken to the pediatrician regularly and they were treating the low body weight. The last physician visit was 16 days before death. In view of these issues, the manner of death is best certified as "Undetermined."

Maybe the question in this case should be formulated, "Do diagnoses of probable cardiac dysrhythmia due to electrolyte abnormalities trump healing and acute rib fractures?" To the anthropologist perspective, this is an unsettling thought. To the medical examiner/coroner, while still unsettling, their responsibilities are medical interpretations of cause and manner of death, not simply biomechanical interpretations of bone fracture. The repercussions of a homicide ruling without a traumatic cause of death are immense. Thus, the debate goes on.

**Child Abuse, Cachexia, Healing Rib Fractures**

## G98 The Identification of French Victims in the Massive Earthquake on January 12, 2010 in Haiti

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The goal of this presentation is to give attendees a clear understanding of France's structure and procedures in terms of identification of its nationals in the event of a major natural disaster and to demonstrate that the international response is as efficient and effective as it is at a national level.

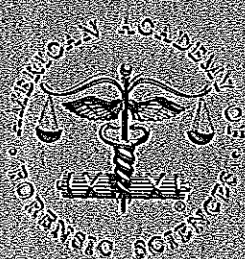
This presentation will impact the forensic science community by showing the successful collaboration between a forensic scientist and a first response rescue team. To illustrate this, the French national team of identification was followed on site at Port-Au-Prince from January 13, 2010 until April 1, 2010. It also demonstrates that an early intervention is key to optimizing the effectiveness of the identification process and to achieving the overall success of the operation.

The earthquake that struck Haiti's capital Port-au-Prince caused more than 200,000 deaths. The major contributing factors to such high casualties were primarily its incredible strength and secondly the

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