Virtopsy : An Investigation In Forensic Identification-A Review

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Abstract: Autopsy is one of the very oldest methods. With the technologies being improved the forensic experts can make the dead talk. Virtual autopsy is a helpful and complimentary tool for medical cadaveric examination. The aim is to establish an objective, observer independent and modern imaging techniques, leading to minimally invasive "virtual autopsy" methods to investigate a case. This method elaborates the review of maxillofacial imaging in image guided virtual autopsy. The project VIRTOPSY combining the research topics under one scientific umbrella The advance imaging techniques such as computed tomography (CT) and magnetic resonance imaging (MRI) ,3D surface scanning and modern radiological procedures is used in virtual autopsy in order to visualize and reconstruct the internal organs to know the site, type, and depth of injury.

Keywords : Forensic examination , Virtopsy , Maxillofacial imaging , 3D Surface Scanning.

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1.INTRODUCTION

To solve various mysterious cases and to identify the person, gender and cause of death of the cadaver, forensic examination plays a vital role. There are various techniques being followed to investigate a medico-legal cases ,of which autopsy is the primary investigation .Due to emotions and rituals being followed by relatives postmortem is a disturbing method nowadays. Changes which are not clinically visible can be recorded with the help of radiological activities like performance , reporting and interpretation in forensic technology. While evaluating the cause of death in disastrous conditions and criminal investigations, Forensic radiology plays an important role. Autopsy is the systemic and scientific examination of a dead body to determine or confirm the cause of death. They are of three

types namely clinical or pathological, medico-legal and anatomical.

- Clinical/ Pathological autopsy is done to determine the disease causing death and a pathologist performs it with the consent of relatives of the deceased.
- Medico legal autopsy is done to solve the mysterious unnatural death and is done by a Forensic pathologist or medico-legal expert ideally. Anatomical autopsy is carried out to learn the normal structure of the human body by medical students.
- Forensic pathology examines the victims of suspected,obvious or possible violence that are preoccupied. Clinical Forensic Medicine deals with living victims.

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Virtopsy is one step towards this end. The term Virtopsy came from Virtual autopsy, which is a scalpel free procedure of autopsy carried out using modern medical, imaging and measuring technology. Dissection of the body organs and opening of the body cavities is not required in this imaging technique. Different techniques of imaging to provide a 3D view of the interior and exterior of the body with vital information and pathological conditions of wounds can be known by non invasive procedures. The technique could offer an alternative to the standard invasive procedure that upsets many families and is prohibited by some religions, the developers say.

"If we are performing an autopsy procedure, we are always destroying the 3-Dimensional geometry of the body," says Thali, the project manager and forensic pathologist.

2. THE VIRTOPSY METHODOLOGY

MANNER OF DEATH
These five categories of death are:
3.1.1 NATURAL CAUSE: When the body ceases to function of its own accord or if there are mitigating medical factors such as terminal illness, heart disease which would bring death and it is referred as death by natural cause.
3.1.2 HOMICIDE: The taking of one human life by another human being by means of pre-meditated murder. The term pre-meditated means to have purposely planned and executed the murder of another human being in cold blood whilst trying to elude capture by the authorities.
3.1.3 ACCIDENTAL DEATH: accidental death can also be categorized as death by misadventure. This means the victims have put themselves in mortal danger by taking risks and died due to accidental causes.A lot of extreme sports participants have died due to accidents.
3.1.4 SUICIDE: the deliberate taking of one's own life due to extreme emotional distress often brought about by severe depression. Suicide is neither accidental nor classified as death by misadventure simply because the individual has set about on a course of action that would end with their own inevitable death. Normally this would occur by means of drug overdose, the cutting of one's own wrist to induce uncontrollable bleeding, or indeed stepping out in front of a moving vehicle.

3.1.5 UNDETERMINED: When there is no sufficient circumstances to surround the death , the forensic pathologist will rule it as undetermined death. The aim of our study was to retrospectively analyze a series of Suicide rates autopsy cases that were classified as undetermined manner of death after complete investigations. In all, 48 cases were examined. Death was determined in 48% of the investigations (23 cases).A wide range of situations and homicide conditions were pointed out in undetermined investigations.

Shootings Bullets will frequently lodge in a position far from their entry points, particularly if they are deflected by a curved bone such as ribs or the skull. It is found that 3D MDCT data can minimize the location uncertainty of bullets, entry and exit wounds. Bullets depth and information about the angle and direction of fire is the investigation to be done.

Pre Processing and Technical Background:
In this method, the image acquisitions of the CT input gray scale image is set into the preprocessing techniques and segmented by using otsu's thresholding techniques and get the output image as binary image. By using morphological operations to normalized the binary image and calculate the volume area of the gunshot region.
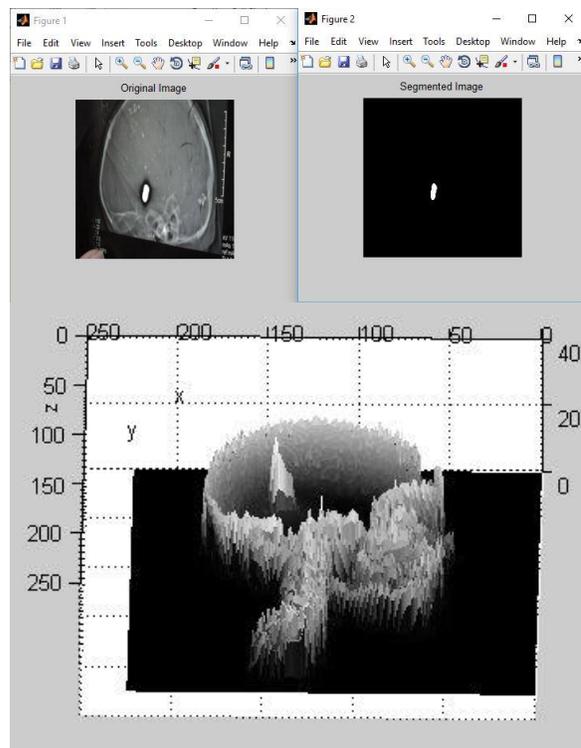
Step 1: Read the input image
// Using Otsu's Method
Step 2: Convert the grayscale image into binary image
Step 3: apply the Morphological Normalization
Step 4: Get the volume of the Gunshot region

In the following output, we have to find the depth of the bullet region based on maximum peak pixel region present in the skull region.

Advantages :
- Post-mortem imaging can demonstrate findings that are not readily recognized during the traditional autopsy such as fast and accurate identification of foreign objects (bullets) in decomposing bodies, documentation and examination of neck muscle hemorrhages in Forensic cases, visualization and quantification of venous air embolism structure.
- IA offers excellent accuracy, including very close estimation of solid organ weights and the ability to match decedent-environment relationships in fatal traumatic injuries. In severe putrefaction visualizations of several soft tissue patterns were analyzed by an imaging procedure which is very important in finding structural patterns that cannot be found using autopsy procedure.
- Imaging Autopsy produces detailed records that show conclusively the cause or manner of death which can be kept intact and free of human intervention.
- The burden of determining the identity and cause of death in victims of mass natural disasters, particularly in large number of badly decomposed bodies were easily identified..

Limitations :
- All the pathological conditions with their analytical data cannot be distinguished when compared to traditional autopsy.
- It exhibits dilemma in differentiating ante mortem/postmortem artifacts; color changes and establishment of infection status.
- Occasionally small tissue injury may be missed.

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CONCLUSION:

Virtopsy using maxillofacial imaging establishes a new technical tool in both research and forensic identification and reconstruction. This system concludes that the Virtopsy using maxillofacial imaging favors the development of future forensic investigations and is helpful in medico legal cases. Due to its non-invasive procedure, virtual autopsy is very much acceptable in our society. Virtopsy is likely to be replaced in USA and Europe. This advanced technology can be utilized to improve the investigation system.

- The project will be worked on with different angles of slices obtained from MRI and CT scanning images so that determination will be more accurate. Maxillofacial imaging can be extended to whole body imaging with further advanced equipments to enhance the quality.

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