

Virtual Autopsy- A New Phase in Radiology

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Abstract:- In the field of forensic science, an autopsy, usually referred to as a postmortem examination, is an invasive technique performed to determine the cause and manner of death after a death has happened. Technology improvements have given rise to a new term, "virtopsy," which describes a virtual autopsy that makes use of imaging methods like computed tomography and magnetic resonance imaging. It entails scans of dead bodies that are hardly obtrusive. It is a great substitute for a traditional autopsy since it provides a complete examination of the entire body in less time, helps with diagnosis, and takes religious considerations into account. The approach provides more precise, sensitive, and instinctive court evidence for fractures, soft tissue injuries, organ damage, and wound extent. This review article will address the usefulness of "Virtopsy" in the field of forensic science and its possible use in forensic crime investigations.

Keywords:- Autopsy, Virtopsy, Radiology, Forensic, Computed Tomography, Magnetic Resonance Imaging.

I. INTRODUCTION

Virtual Autopsy means we do the postmortem of body with the help of virtual equipment. The two word VIRTUAL and AUTOPSY which combine to form VIRTOPSY. As we can say that Virtopsy or virtual autopsy is scalpel free or non-invasive procedure for autopsies. For forensic investigation many degrades bodies are come for autopsy but due to degrade condition of body, forensic experts faces some difficulty during postmortem procedures. After introduction of virtual process in autopsy it becomes easier for forensic expert because it takes less time than normal autopsies. In the department of radio imaging and diagnosis uses various types of radiation modalities in which Computed Tomography and Magnetic Resonance Imaging used for Virtual Autopsy. These equipment are helpful to the body because it is safe and body remains same and we find the cause of death easily.

The virtual Autopsy leads to various departments such as criminalistics, engineering, general jurisprudence, odontology, pathology, psychiatry and behavioral science, toxicology, radiology, and physical anthropology.(1)

This article reviews on "Virtual Autopsy" where in various article were located through PUBMED, Research gate, Google Scholar and relevant data were find and summarize.

II. HISTORY

Richard Dirnhofer, a former director of forensic medicine at Berne, created the Virtopsy. Later, it was continued by his successor Michel Thali and his coworkers at the Institute of Forensic Medicine at the University of Berne in Switzerland.(2) Herophilus and Erasistratus dissected corpses in order to investigate the organs and nerves. The first autopsy was done in 1700 by Giovanni Morgagni, who also wrote a book in 1761 titled "The Seats and Causes of Disease" that included descriptions of 700 of his own autopsies. William Osler is credited with first introducing autopsy as a subject in medical school in the year 1800. The earliest tests with simple X-rays were carried out in November 1895 by the German scientist Wilhelm Röntgen, and they were first detected on November 8, 1895. Forensic professionals used photography and traditional radiography procedures as two of their primary tools for producing reliable reports.(1) In patients with cranial gunshot wounds, computed tomography (CT) scan for forensic inquest was first described in 1977. In 1983, Krantz was a pioneer in the use of CT scans during autopsies, and since then, with the development of new technology in diagnostic radiology, the use of postmortem imaging has increased.(2) In 1999, a group launched the first body scans for a well-known case under the labels "digital autopsy" or "scalpel free autopsy." The virtopsy project was so integrated. The Virtopsy project was not the first trial to use postmortem computed tomography (CT) or magnetic resonance imaging (MRI) scans globally, but it was the first to integrate a wide range of technologies, including CT and MRI, invasive biopsies, and three-dimensional (3D) external scanning, while also examining a greater number of cases over a longer period of time and in a more organised fashion.(1) After the creation of the "Virtual Mummy" at the British Museum in 2004, the groundwork for the use of digital autopsy was set. (2)

III. EQUIPMENT USED FOR VIRTUAL AUTOPSY

Every time a photograph is taken, the subject is always shown in two dimensions. In other words, an image of a wound will only capture its location, length, and breadth, not its depth. Therefore, a three-dimensional picture of the wound is required to calculate the depth since it displays the wound's actual dimensions. As a result, Virtopsy combines a number of technologies from many scientific disciplines with those from imaging techniques used in medicine.

A 3-D surface scan, also used in automotive design, is used to map the exterior of the body. It presents a three-dimensional illustration of the body's surface area and discusses it in detail. Using magnetic resonance imaging (MRI) and multi-slice computed tomography (MSCT), which allow for the precise gathering of information on the condition of numerous organs, it is possible to view within the body. Depending on the circumstances, a bodily part may be evaluated slice by slice in different planes. Additionally, the analysis of chemicals in the brain that appear during post-mortem decomposition using magnetic resonance imaging spectroscopy may be used to determine the time since death. If necessary, CT guided needle biopsy can be used to obtain samples more accurately for histological analysis. Angiograms performed after death are utilized to see the cardiovascular system. (3)

IV. DIFFERENCE BETWEEN VIRTUAL AUTOPSY AND AUTOPSY

Virtual autopsy is less invasive and hands-off as compared to a traditional autopsy, which is invasive and hands-on. The benefits of virtualopsy and autopsy are not the same. Still, virtopsy falls short of autopsy in terms of overall sensitivity. The main advantages of virtopsy over traditional autopsy are that it is quicker and doesn't infect the pathologist or the body. It could even be done after the body has decomposed. Given that virtopsy respects the body, religions also encourage it. Jews are strongly opposed to autopsies. When determining the depth of foreign substances and bone fracture lines, virtual tomography is more precise. Additionally, it functions better in some people with cranial and bone injuries. Virtopsy is more sensitive than autopsy in detecting vascular disorders, haemorrhages, and irregularities in the bones. However, it is insensitive to parenchymal lesions. Traditional autopsy, as opposed to virtopsy, offers the advantage that the pathologist may assess the cadaver's smell, feel, and touch. Additionally, a traditional autopsy made it possible to spot parenchymal defects more easily. Traditional autopsy is preferred than virtopsy for assessing soft tissue. (4)

V. TYPES OF VIRTUAL AUTOPSY

➤ *Imaging Techniques Applied 3D Surface Scan*

A three-dimensional image of the wound is necessary to determine its real size, and it may be acquired without causing tissue damage.

➤ *Multi-Slice Computed Tomography (MSCT)*

MSCT is an imaging technique that creates a single image by serially capturing a number of rows of CT detectors. The finest details of soft tissue and bone injury may be promptly and effectively captured. (5)

➤ *Magnetic Resonance Imaging (MRI)*

It tracks the state of several organs and visualises the body's inside in order to collect detailed data. After analysing the metabolites generated in the brain during post-mortem decomposition, 6 which are measured in MRI Spectroscopy, the time since death may be calculated.

➤ *Microtomography*

The weapon in question and the three injury patterns are studied using this technique.

➤ *3D Facial Reconstruction*

Sutures join the bones that make up the human face. Face reconstruction uses the deceased's bone fragments to help recreate the facial morphology. The first face reconstruction was recorded in 1895. Approaches for facial reconstruction are crucial in circumstances where conventional identification methods fail. The 1946 classification of traits that offer an accurate image of any deformed cadaver and help in its identification included the connection between the eyeball and orbit, the shape of the nose tip, the location and length of the ear, and the breadth of the mouth. Therefore, facial reconstruction is the best technique for producing images that closely match how a face would have looked in real life.

➤ *Photogrammetry Based 3D Optical Scanning Using the Gom Tritop/Atos 2 System*

In prototype and design technology, 3D optical scanning is a technique used for 3D photogrammetry documentation and measurements. This is a very accurate approach that can completely document the entire body or entire vehicle, not only the interior features of components like skin or an instrument.

➤ *Post Mortem CT Angiography*

It makes the circulatory system easier to see and identifies blood capillary damage that would frequently go unnoticed in a conventional autopsy. The CT scans will reveal any vascular injury, and contrast will be interpreted as overflow 9.

➤ *Post Mortem Biopsy*

Pathology examination may involve the use of a biopsy needle or gun. This can be used when some cancer or lesional tissue 10 has to be studied.

➤ *Maximum Intensity Projection (MIP)*

It is a rapid imaging process that may quickly put together all of the deceased body's radiographic models.(5)

VI. USES

Radiology was the most effective tool for locating skulls, craniums, or suspected injuries in biopsy tissue during autopsies. For several forensically important bodily reactions, computed tomography and magnetic resonance imaging were both equally efficient diagnostic tools. The introduction and evaluation of radiography in forensic research appears to be more promising based on these first findings, which are based on the concept of a virtual autopsy.

Timing of death, For individual identification, For toxicological examination, Used for RTA patients, Used in cardiorespiratory failure from non-traumatic origin, Used in hanging or manual strangulation, In death due to burns, Gunshot wounds, In drowning deaths and For age and sex determination.

➤ *Advantage*

It may be used for telemedicine, teleforensic, and telepathology. It features 3D drawings, is easily accessible, allows for digital re-examination of the corpse after discharge from the crime scene and burial or root of the corpse even decades afterwards.(6)

- It can be used on bodies that have been exposed to radiation or severely polluted bodies since there is less dissection of the body.
- Family members prefer it since it is unobtrusive.
- It creates data that is permanently stored and saves time.
- Opinions are more objective and independent of the observer.
- It permits repeated investigation of the same body by other forensic experts, providing for the prospect of getting second or third view years later should new allegations appear.
- It may be used to augment conventional autopsy and improve the quality of autopsies.
- The use of visualisation tools enhances the precision and efficacy of forensic procedures and may reduce the danger of disease exposure for forensic professionals.
- A virtopsy maintains the human tissues in contrast to a traditional autopsy.
- The virtopsy technique is designed to be utilised in circumstances when it is impracticable to dissect the body or if it is extraordinarily difficult to view forensic evidence, according to its authors, rather than replacing normal autopsy.(3)

➤ *Disadvantage*

It includes the touch, feel and smell senses of forensic personnel that are present.

VII. CONCLUSION

Virtopsy acquires images using a 3D approach. Compared to manual autopsy, it is far more useful. Maintaining a dead person's privacy and perfecting their final chapter of existence lends itself to futuristic developments.

Funding Acknowledgement: None

Acknowledgement: None

Conflict of interest: None

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