



REVIEW

Virtopsy- A Moral Boon In Forensics

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ABSTRACT: Death is an inevitable part of life and at few occasions scientific examination of bodies after death becomes mandatory. The contribution of Forensic science in achieving this is noteworthy. Forensic pathology is a discipline of Forensic science which deals with pathologic and physiologic changes of a body before and after death wherein autopsy plays a significant role. Conventional Autopsy involves Invasive body opening – the traditional means of postmortem investigation in Humans. Contrary to it is Virtopsy, a minimally invasive emerging technology in the field of Forensic medicine which incorporates Imaging technology that relies on certain fundamental pillars which include - Three dimensional surface scanning 3D/CAD photogrammetry , MSCT- multi slice computed tomography, MRI- magnetic resonance imaging and Magnetic resonance imaging spectroscopy. Thus serving as a moral boon in the field of forensics is Virtopsy which provides a platform wherein radiologists and forensic clinicians reflect an ethical face in forensic examination after death.

Keywords: virtopsy, forensic science, autopsy, forensic medicine

Death is an inevitable part of life and at few occasions scientific examination of bodies after death becomes mandatory. Modern day investigations have reached a point of sophistication interconnecting the involvement of many different disciplines to serve problems including establishing reasons for death. The contribution of Forensic science in achieving this is noteworthy.

Forensic Science is an area of specialization that can be used in a judicial setting and involves principles and procedures for the systematic application of knowledge involving collection of

data through observation and experimentation thus leading to recognition and formulation of a problem. It involves 10 disciplines which include Crimanilistics, engineering science, general, jurisprudence, odontology, pathology/biology, psychiatry and behavioral science, questioned documents, toxicology and physical anthropology.

Forensic pathology is a discipline of Forensic science which deals with pathologic and physiologic changes of a body before and after death wherein autopsy plays a significant role which deals with establishing the circumstance leading to death by scientific examination of the whole surface of the body as well as body cavities

[1].

HISTORY OF AUTOPSY

Greek physicians Erasistratus and Herophilus dissected cadavers to study the working of organs and nerves². It was in 1700 when Giovanni Morgagni – the founder of today’s autopsy wrote a book on “The seats and causes of Disease investigated by anatomy and published it in 1761 in which he described 700 autopsies that he performed. Susequently Matthew Baillie, in 1793 wrote a textbook on Morbid Anatomy of the Human Body and its accompanying atlas, 6 years later. This adopted a new and convenient method of describing pathology according to the organs involved rather than according to symptoms, as Giovanni Morgagni (1682-1771) of Padua had adopted in his *De Sedibus et Causis Morborum* (On the sites and causes of disease)^[2].

In 1800, William Osler who taught medicine placed autopsy at the centre of the medical education^[3].

AUTOPSY VS VIRTOPSY

Autopsy is a combination of old Greek terms ‘Autos’ meaning self and ‘opsomei’ means ‘I will see’. Thus autopsy means ‘to see with one’s own eyes’. An autopsy consists of several parts charting all the external injuries, anatomic dissection, histologic studies and cultures^[4]. The term Virtopsy coined by Thali M.. et al is created from the terms Virtual and Autopsy where Virtual is derived from

the latin word “Virtus” which means ‘useful, efficient and good’ and elimination of autos ie, self thus leading to the scientific umbrella Virtopsy. Virtopsy is a transdisciplinary technology that combines Forensic medicine, pathology, radiology, image processing, physics and biomechanics^[5].

VIRTOPSY: A MORAL BOON IN FORENSICS

Conventional Autopsy involves Invasive body opening – the traditional means of postmortem investigation in Humans. Contrary to it is a minimally invasive emerging technology in the field of Forensic medicine which incorporates Imaging technology wherein radiologists and forensic clinicians reflect a ethical face in forensic examination after death through the art of Virtopsy^[6].

FORENSIC – RADIOLOGY BRIDGE

An insight into the future of forensic is explored by the evolving involvement of imaging technology that can augment or even in the future may be an alternative to conventional forensic examination. It relies on certain fundamental pillars which include – a)Three dimensional surface scanning 3D/CAD photogrammetry for the documentation of body surfaces, b)MSCT- multi slice computed tomography, c)MRI- magnetic resonance imaging both of which visualizes the interior of the body for collection of all the data wherein examination of

part of the body slice by slice in different planes is achieved according to the requirement of the situation, d) Magnetic resonance imaging spectroscopy that estimates the time since death by measuring the metabolites in the brain emerging during post mortem decomposition^[7].

IMAGE GUIDED IDENTIFICATION

Virtopsy is an investigator independent, objective; non invasive imaging guided qualitative improvement in forensic pathologic investigation augmented by modern cross sectional imaging technique. The computed tomography plays an important role as an imaging modality for two and three dimensional documentation and analysis of autopsy findings including gross tissue injury and pathologic gas collections. Concurrently MRI has a greater impact in soft tissue injuries. The future application of these imaging guided techniques in identification shall extend even towards routine screening of bodies prior to burial^[8].

VIRTOPSY: BENEFITS AND PITFALLS

Advantages

1. It is a Scalpel free non invasive imaging technology.
2. It is digitally storage over years or decades and even transferrable over the web for second opinion.
3. It is an ethical evolution which serves better acceptance for the relatives of the deceased

(dead) and also by certain religious customs where incisions are not recommended after death.

4. Since there is no mutilation of the body no hazard of infections from the blood or other tissue fluids.
5. It is less time consuming and body can be released immediately after the scanning.

Disadvantages

1. It is not possible to distinguish all the pathological conditions with this technique and it is associated with insufficient data base when compared to conventional autopsy.
2. It exhibits dilemma in differentiating ante mortem/postmortem artifacts; color changes and establishment of infection status.
3. Occasionally small tissue injury may be missed^[9].

VIRTUAL AUTOPSY: A CUTTING EDGE

Studies conducted to compare Autopsy and Virtopsy revealed the cutting edge of Virtopsy in determining the cause of death, eliciting relevant traumatological and pathological findings, vital reactions, reconstruction of injuries and visualization of forensic cases. This also led to an opportunity to utilize the data for expert witness reports, teaching, quality control and telemedical consultation^[10].

VIRTIBOT AND VIRTUAL AUTOPSY

Current advances in the field of medicine are crossing milestones contributing enormously in various fields of science. Nanotechnology can be defined as the technology that has allowed for the control, manipulation, study and manufacture of structures and devices in the nanometer size range [11].

Virtibot is a Robotic technology that carries out Virtopsies. They are multifunctional robotic system that serves to perform 3D surface scanning and automatic post mortem image guided biopsies. Emerging as a newest technology the virtibot bridges forensic science, diagnostic imaging, computer science, automatic technology, telematics and biomechanics thus is a qualitative reflection improving the outcome of forensic investigations [12].

CONCLUSION

Concurrent with Virtual Autopsy offering an ethical support in Forensic examinations, the future may even see the up rise of a milestone in routine Histology wherein Magnetic resonance microscopy in the examination of forensic tissue specimens shall emerge as Virtual Histology, a merging milestone together with Virtual autopsy thus depicting the merciful scientific milestone after death [13].

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