Journal of Advanced Clinical & Research Insights (2018), 5, 38–40

REVIEW ARTICLE

VIRTOPSY: An emerging tool

Tejavathi Nagaraj, Haritma Nigam, Sita Gogula, C. K. Sumana, Arundhati Biswas

Department of Oral Medicine and Radiology, Sri Rajiv Gandhi College of Dental Sciences and Hospital, Bengaluru, Karnataka, India

Keywords:
Forensic, imaging, virtopsy

Correspondence:
Dr. Haritma Nigam, Department of Oral Medicine and Radiology, Sri Rajiv Gandhi College of Dental Sciences and Hospital, Bengaluru, Karnataka, India.
E-mail: dr.haritmanigam@gmail.com

Received: 05 January 2018;
Accepted: 08 February 2018

Doi: 10.15713/ins.jcri.205

Abstract

Forensic odontology has been an upcoming branch in forensic medicine for personal identification. Currently, new technologies and advances are upcoming in forensic medicine. Autopsy was used as diagnostic tool in the ancient era, but now virtopsy appears to be a modification of autopsy in which pictorial, photographic, and radiological evidences are composed altogether through imaging. It utilizes images which provide an effective and more precise explanation in every case. This is a review article which apprises on the beginning, applications of virtopsy in dentistry.

Introduction

Forensic odontology or forensic dentistry is an inspiring and captivating branch of forensic science and was defined in 1970 by KEISERNEILSON as "that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings." Human identification is a most personified field which gratifies the mankind in diverse manners.[1] Thus, the importance of dental identification is growing now. Its important applications include in identification of human dental records and assisting at the scene of crime, child or adult abuse, and age and gender determination, as an expert witness in the court. Forensic maxillofacial radiology, a specialized area plays an important role in achieving its goal to an extent.

Definition

Autopsy is derived from two Greek terms Autos which means "self" and opsome means "I will see." Hence, it literally means to see with "one's own eyes." Autopsy is utilized in registering all the external injuries, anatomic dissection, histologic studies, and cultures.[2]

On the other hand, the term virtopsy was coined by Thali *et al.* which is composed of virtual and autopsy where virtual is derived from the latin word "virtus" which means "useful, efficient and good" and elimination of autos, i.e., "self." Virtopsy is a transdisciplinary technology that associates different branches as forensic medicine, pathology, radiology, image processing, physics, and biomechanics.[3]

History

- 1977 - Forensic application of computed tomography (CT) scan described first as the pattern of a gunshot injury to the head by wulleweber.
- 1989 - Kalender *et al.* introduced spiral CT opening the door for three-dimensional (3D) data acquisition and processing.
- 1990 - Concept of objective, non-invasive documentation of the body surface for forensic purpose with the development of photogrammetry.
- 2000 - Observer independent documentation of the body surface is combined with observer independent documentation of the interior of the body.
- This has now been made possible by the virtopsy project of the institute of forensic medicine, diagnostic radiology and neuroradiology at the University of Bern, Switzerland by the team led by Richard Dirnhofer, Thali *et al.*[3,4]

Virtopsy that uses latest radiological techniques

- Virtopsy is used as a substitute to standard autopsies for an overall examination of the entire body and is beneficial as it utilizes is less time, supports improved diagnosis and maintains religious beliefs. It is a combination of surveying technology, pathology, radiology, image processing, computer sciences, telematics, physics, and biomechanics.[5]

Virtopsy Tools

- Virtopsy basically consists of:
  a. Body volume documentation and analysis using CT, magnetic resonance imaging (MRI).
  b. 3D body surface documentation using forensic photogrammetry
  c. (C) 3D optical scanning.

Virtopsy is based on the principle of triangulation in which 3D imaging is used in postmortem victims.[6]

Procedure

Step 1: Prepare the body for imaging.
Step 2: Virtobot, marks on the external of the cadaver.
Step 3: After marking virtobot takes a 3D color model to the body.
Step 4: Uses stereoscopic cameras for capturing the color image and then a projector cast a mesh pattern on the body.
Step 5: After the creation of the image picture can be manipulated on a computer screen for further identification of the tattoos by the investigators.
Step 6: Tripods and cameras are placed by virtobot at various points around the body. The robot then glides over the body creating a 3D image.
Step 7: After the surface scanning the body is carried to the CT and MRI labs doubly enfolded in blue bags through which X-rays can be passed.
Step 8: The bag remains closed while the body is scanned and hence the body's privacy is protected, and cleanliness in the room is also maintained.
Step 9: X-ray slices of the body are reconstructed b y the computer within 19 min into detailed images of bone and tissue.
Step 10: There are color coding as pockets are blue, soft tissues are beige, blood vessels are red, and bone is white.
Step 11: Manipulation of patterns and images can be done and turned to various angles.
Step 12: The virtobot can also perform needle biopsies if body samples are required.[4]

Virtual Autopsy Table

- Dr. Anders Persson, director of the Linköping University Centre for Medical Imaging Science and Visualization, Sweden has created "the virtopsy table."
- A large touch-sensitive liquid-crystal display screen represents the operating table displaying the image of the body.[4]

Advantages

1. It is a non-invasive imaging technology.
2. It can be stored digitally over years or eras and can be used in telemedicine.
3. It is an ethical evolution and maintains religious believes where incisions are not recommended after death.
4. No danger of infections from the blood or other tissue fluids.
5. Time consumption is less and body can be released immediately after the scanning.[7]

Disadvantages

1. Unable to distinguish all the pathological conditions with this technique.
2. No infection status.
3. Color changes cannot be appreciated.
4. Small tissue injury may be missed.[7]

Applications

1. It helps in diagnosing the cause of death, especially in drowned bodies as CT gives information about the volume, density, size of the lungs, and the amount of liquid observed in them.[8]
2. Injuries of firearm projectile.[9]
3. Human identification in mass disaster cases describes for the comparison between AM and PM reconstructed panoramic radiographs, CT, and magnetic resonance imaging.[10]
4. Determination of age of charred bodies.[11]
5. Authors worked on restorative materials related on the virtual technique. They expressed in Hounsfield Units the different density of restoration materials, such as composites, temporary fillings, and ceramics, by ultra-high-resolution CT imaging.[12]
6. Oesterhelweg *et al*. reported a case where the victim was collided with by respiratory obstruction from a foreign body (food bolus) which was very well appreciated in combined CT and MRI rather than conventional autopsy examinations. [13]
7. Forensic reconstruction: Impact direction, entrance and exit wounds, medicolegal issues, specific forensic findings, such as burnt corpses and putrified corpses, bite mark registration and analysis, application of minimally invasive technique for collection of tissue samples and also urine, bile, blood for toxicology or deoxyribonucleic acid analysis, "shaken baby syndrome" cases, and morphologic fingerprints.

Conclusion

Virtual autopsy arises as a valuable diagnostic tool for forensic investigations. It has provided an improved collection of data compared to the traditional technique. It has shown the probability of visualizing 3-D anatomical structures systematically, in real time, without causing detrimental harm to the body without any contamination from cadaver's substances is consider to be an supplementary gain. However, like any other new trend in science, the virtual autopsy is still developing and getting space among the commonly used methods.

References

1. Reddy S. Unleash the unknown-frontal sinus and nasal septal patterns in personal identification. Int J Dent Sci Res 2014;2:141-5.
2. Wright JR. Sins of our fathers: Two of the four doc-tors and their roles in the development of techniques to permit covert autopsies. Arch Pathol Lab Med 2009;133:1969-74.
3. Thali MJ, Jackowski C, Oesterhelweg L, Ross SG, Dirnhofer R. Virtopsy–the swiss virtual autopsy approach. Leg Med (Tokyo) 2007;9:100-4.
4. Navalkar AR. Virtopsy-the scalpel free autopsy: A review of literature. J Contemporary Dent 2015;5:168-72.
5. Zimmermann D. Virtopsy and forensic imaging: Legal parameters and impact. Asia pacific coroners society conference, noose, Queensland. Leg Med 2007;9:100-4.
6. Tejaswi KB, Periya EA. Virtopsy (virtual autopsy): A new phase in forensic investigation. J For Dent Sci 2013;5:146-8.
7. Patowary AJ. Virtopsy: One step forward in the field of forensic medicine – A review. J. Indian Acad For Med 2008;30:32-6.
8. Levy AD, Harcke HT, Getz JM, Mallak CT, Caruso JL, Pearse L, *et al*. Virtual autopsy: Two 11 and three dimensional multidetection CT findings in drowning with autopsy comparison. Radiology 2007;243:862-8.
9. Levy AD, Abbott RM, Mallak CT, Getz JM, Harcke HT, Champion HR, Pearse LA. Virtual-22. autopsy–preliminary experience in high-velocity gunshot wound victims. Radiology 2006;240:522-8.
10. Dirnhofer R, Jackowski C, Vock P, Potter K, Thali MJ. Virtopsy–minimally invasive, imaging 21. guided virtual autopsy. Radio Graphics 2006;26:1305-33.
11. Dedouit F, Telmon N, Costaglioga R, Otal P, Joffre F, Rougé D. Virtual anthropology and 25. forensic identification: Report of one case. Forensic Sci Int 2007;173:182-7.
12. Jackowski C, Wyss M, Persson A, Classens M, Thali MJ, Lussi A. Ultra-high-resolution 19. Dual-source CT for forensic dental visualization–discrimination of ceramic and composite fillings. Int J Legal Med 2008;122:301-7.
13. Oesterhelweg L, Bolliger SA, Thali MJ, Ross S. Postmortem imaging of laryngeal foreign 23. bodies. Arch Pathol Lab Med 2010;133:806-10.

How to cite this article: Nagaraj T, Nigam H, Gogula S, Sumana CK, Biswas A. VIRTOPSY: An emerging tool. J Adv Clin Res Insights 2018; 5: 38-40