

Newer Techniques for Autopsy: (Autopsy Minus the Scalpel): Future of Forensic Medicine

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Abstract:

For many people of different faiths, cutting up a corpse to figure out, how a person died is an invasive, even offensive, procedure. In some cases, as with Muslims and Jews, autopsies may violate their religious laws. But technology is stepping in with a more acceptable alternative to traditional autopsies, using sophisticated scanning and three-dimensional computer systems.

Keywords: Forensic radiology; 3D surface scanning; Virtopsy; Virtual autopsy

Introduction

Autopsy (auto-self +optosi-seen) - means 'to see with one's own eyes'. In India, there is provision for a complete postmortem examination. Every cavity of the body should be examined.

History of the autopsy

Autopsies are a source of valuable medical information that can improve health care for the living. Batista Morgagni Greek physicians performed autopsies 2,500 years ago, but it wasn't until 1769 that the first comprehensive pathology text was written. The Italian physician Giovanni Batista Morgagni published his book '*The seats and causes of diseases investigated by anatomy*'. [1]

Aims and Objectives

Aims and objectives of the postmortem examination are to:

1. Who died? (Identification of the deceased).
2. Where? (Place of death).
3. When? (Time of death).
4. Why? (Cause of death).
5. How? (Manner & mechanism of death).

Permission for autopsy

A written request must come from the Police Officer, who is the investigation officer. In circumstances where the SHO/Inspector is busy and not available, he should get permission from the Deputy Commissioner to depute one junior officer for the same.

The inspector should take the charge of the case once he is free. There are certain types of cases where the Magistrate holds an inquest and the request for autopsy should come from the Magistrate.

Types of Autopsy

Medico legal autopsy

It is conducted in the department of forensic medicine of a Government Hospital. The

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request comes either from the police or SDM, who is the Investigation Officer of the case. The consent of the relatives is not required. The doctor conducts a full and Complete postmortem to find out the cause of death.

Pathological autopsy

It is conducted by the Department of Pathology and request comes from the relatives, who are the consenting party. In these cases the doctor conducts a partial autopsy of the organ or cavities where the pathologist is suspected to find out the cause of death.

Minimum Requirement for autopsy

- Mortuary should be well lighted.
- Postmortem instrument case contains all that might require.
- Liberal supply of water must be arranged.
- Risk of infection is real danger, proper protection in form of gloves, apron, mask should always be taken.

Procedure of autopsy

External examination

- a) General description like build, length, sex should be noted.
- b) Any blood stain, tear in clothes should be noted.
- c) Sample of blood, saliva, and semen may be collected in appropriate case.
- d) Measurement of postmortem interval by assessing changes after death should be done.
- e) All wound on body should be meticulously described.

Internal examination

Any one of following incision may be followed depending upon case:

I-shaped incision: Straight incision from

sternal notch to symphysis pubis .

Y-shaped incision: Two incisions commencing on either side of chest curving under breast to meet at Xiphi sternum and continued vertically downward up to symphysis pubis.

Modified Y-shaped incision: Two incisions behind lobe of each ear to meet at m.sterni and continued up to pubic symphysis. Internal examination is complete only, when all three body cavities are opened. The order of dissection varies according to requirement of case.

Newer Techniques for Autopsy (Autopsy minus the scalpel)

The quest of men to explore newer and better techniques is never ending. Performing autopsies by dissecting the body cavities is an age-old process and is claimed as 'gold standard' by many. However, some argue against it.

The major objections to the Conventional autopsy is:

- a) Inhuman and unhygienic process;
- b) Disfigurement and mutilation;
- c) Cultural and religious reservations;
- d) Absence of objectivity.

In order to overcome these drawbacks, newer techniques have been tried and advocated. They are based on endoscopic and radiological examination. Radiology was used in postmortem examination more than a century ago for the first time and ever since radiological investigations are frequently employed in autopsies. However CT and MRI were utilized in postmortem examination only during last decade.

Virtual Autopsy

During the last few years, modern cross-sectional imaging techniques have appeared in Forensic Medicine. Magnetic Resonance Imaging (MRI) and Multislice Computed Tomography (MSCT) are increasingly implemented in Post-mortem examination. These

non-invasive techniques can augment and even partially replace traditional autopsy. With the use of these methods, a minimally invasive, objective and investigator-independent documentation of forensic cases can be realized to reach qualitative improvement in forensic pathological investigation.

Virtual Autopsy Background

The first application of Computed Tomography (CT) in forensic medicine was done by Wullenweber (1977) to describe the pattern of gun shot injury of the head'. Since 2000, Michael Thali and colleagues of the Institute of Forensic Medicine in Bern, Switzerland in collaboration with the Institute of Diagnostic Radiology.

Bern have been developing a bloodless and non-invasive form of digital autopsy 'Virtopsy' basically consists of a) body volume documentation and analysis using CT (Computed Tomography), MRI (Magnetic resonance imaging) and micro radiology; b) 3-D body surface documentation using forensic photogrammetry and 3-D optical scanning which can document wounds and compare them with the suspected weapon. The resulting data set contains high-resolution 3-D colour-encoded documentation of the body surface and 3-D volume documentation to the interior of the body. Radiologists then create full 3-D visualization of the deceased to examine the condition of bones, tissues, organs and blood vessels for clues to the cause and manner of death.

With CT fluoroscopy, an image-guided biopsy can obtain a tissue specimen examination. With CT fluoroscopy, an image-guided biopsy can obtain a tissue specimen for histopathological examination. Similarly, gas samples from lungs and samples of stomach content, urine and blood can be obtained through percutaneous rout for chemical analysis in suspected cases of poisoning.

MR Spectroscopy can detect certain metabolic products in a predefined region of brain, which helps to assess the postmortem interval.

MR microscopy has changed the concept of conventional histopathology. Whereas standard histological analysis displays only the isolated plane of tissues that has been sectioned, micro imaging can be used to obtain images of any plane of tissue through the specimen.

Why use advanced postmortem imaging?

There are many reasons to perform imaging autopsy, including:

- a) Cause of death determination;
- b) Decedent gender identification in difficult forensic cases;
- c) Body length and individual decedent feature identification;
- d) Identifying distinct foreign bodies – retained bullets, blades, etc.;
- e) Identification of injuries and forensic reconstructions – three dimensional
- f) Reconstructions, bullet tract identification;
- g) Education and clinical performance improvement process; and
- h) research – from medical to historical (i.e., mummies, etc)

The concept of using CT and MRI technology to obtain autopsy information is slowly gaining popularity. The relatively slow acceptance of IA is likely related to certain medico-legal aspects, uncertainty over who should be responsible for interpreting such studies, as well as the cost and reimbursement associated with these studies. In addition, the precise relationship between IA and traditional autopsy in terms of overall accuracy, overlap of findings, and missed findings remains to be fully described.[2]

Postmortem imaging can demonstrate findings that are not readily recognized during the traditional autopsy. In one study, over 40% of postmortem CT exams were noted to have clinically significant findings that were not identified on traditional autopsy. In addition, CT and MRI autopsy techniques have revealed

unexpected presence of air in various areas of the body and in the circulatory system. The significance of this gas remains to be determined although it has been postulated that it could represent air embolism and/or post-mortem decay depending on its location and timing. In addition, modern CT/MRI technology is also capable of highly accurate estimation of individual solid organ weights, as verified by traditional postmortem examination findings. In the setting of forensic evaluation, three-dimensional surface scanning using multi-slice CT technology provides excellent visualization of injury patterns and allows re-examination of digital images of the decedent long after the actual time of death. Thali *et al* demonstrated how three-dimensional reconstructions based on radiographic autopsy allowed forensic data to be used in connecting decedent injury patterns to vehicle deformities.[3]

Advantages & disadvantages over the conventional autopsy

Advantages

1. Most effective in study of the wounds including the matching of the probable weapon. The wound can be studied without disturbing the body architecture.
2. No scalpel method, so no hazard of infections from the blood or other tissue fluids.
3. No mutilation of the body, so, can be examined again without any autopsy artifacts.
4. The data is stored in digital format, so can be transmitted to any part of the world easily.
5. Less time consuming and body can be released immediately after the scanning.
6. Better acceptance for the relatives of the deceased and also by the religious customs as incisions not are used.

Disadvantages

1. Insufficient data base of comparative study of virtopsy and conventional autopsy.
2. It is not possible to distinguish all the pathological conditions with this technique.
3. Can not give the infection status.
4. Difficult to differentiate antemortem or the postmortem wounds.
5. Difficult to appreciate the postmortem artifacts.
6. Difficult to appreciate the colour changes.
7. Small tissue injury may be missed.

Conclusion

Postmortem radiological examination to detect diseases is a useful tool but it can not replace the conventional autopsy in the present stage. There are differences in the ante mortem radiological findings as well as the postmortem findings which need more intensive study. Moreover, there may be postmortem artifacts and it may not be possible to distinguish between the ante mortem phenomenon and the postmortem phenomenon which is only possible by naked eye examination and many a time by histopathological or histochemical methods only. Never the less, it is a new development in the field of investigation of death, but still it has a long way to go to establish itself as an alternative to the conventional autopsy. Its acceptability in the court of law is to proved. But we can hope that in near future, we all will be accustomed to some kind of virtual autopsy or non invasive autopsy technique which will be beneficial for the courts as well as the autopsy surgeons and the relatives of the deceased.

References

1. Boerhaave Hermann. Atrocis, nec Descripti Prius. Morbi historia. *Translated in Bull Med Lib Assoc.* 1955; 43: 217.
2. AJ Patowary. Virtopsy: One Step Forward In The Field Of Forensic Medicine - A Review. *J Indian Acad Forensic Med.* 30(1).
3. Thali MJ, Yen K, Vock P, Ozdoba C, Kneubuehl BP, Sonnenschein M & Dirnhofer R. Image-guided virtual autopsy findings of gunshot victims performed with multi-slice computed tomography and magnetic resonance imaging and subsequent correlation between radiology and autopsy findings. *Forensic Sci Int.* 2003; 138(1-3): 8-16.

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