



Forensic Medicine: A Synopsis of the Past, Present and a Glimpse into the Future Scenarios

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ABSTRACT

Forensic medicine is the science (as well as the art) of applying medical knowledge, skills (and perhaps even the attitudes) to assist in the process of execution of justice. Forensic medicine is broadly divided into clinical forensic medicine and forensic pathology though the boundaries between the two are merging. Forensic pathology is not a pure science as it is nurtured by many other sciences, sociological/criminological disciplines and law. The principle role of forensic pathology today is to deal with numerous medico-legal issues pertaining to all forms of deaths. To achieve this, the principle approach of forensic pathology today in most of the institutions globally is conducting a standard autopsy. In this review article, we expect to discuss the historical development of forensic pathology up to what it is today, its present role and scope as well as the predictable future of forensic pathology with the recent developments of technology.

Keywords: Forensic pathology; history of forensic medicine; hammurabi code; autopsy; morbid anatomy.

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1. INTRODUCTION

1.1 Historical Aspects of Forensic Pathology

The word 'autopsy' in Greek means 'see for oneself' or 'to see with one's own eyes'.

The history of forensic pathology is not clear-cut and precise as it has multiple gloomy origins from different areas of the world which mingle with each other to form what we recognize as forensic pathology today. This includes the earliest period from pre-history to the beginning of the transitional period in the last years of the 16th century. The history of legal medicine is none other than one facet of human civilization itself. The earliest recorded medico legal expert was an Egyptian polymath called "Imhotep" who lived in the 27th century BC [1]. The earliest period lasted for several thousands of years and during this period, there was no separate entity called 'legal medicine'. Law seemed to have influenced medicine and medicine modified law (as both were bound inextricably by the influence of religion, superstition and magic in the primitive cultures). Evidence to this are found in first known law codes and sacred books of the people of the bygone era. The priest functioned a dual role-as the jurist and the physician (an intermediary between the man and the god) and he promulgated the God-given law. Disease and death were divine punishments. In primitive law codes, social and religious precepts were ill-defined and medical contents were mingled with law.

The Hammurabi Code [2] named after the king Hammurabi of the then Babylon (present day Iraq) had been compiled around 2200 BC. It also deals with the rights, duties and privileges of physicians as well as medical malpractice. Indian Laws of Manu [3] (around 10 BC) deal with competence of witnesses. According to this, the drunk, insane, hungry, thirsty, fatigued, those with defective sense of organs were not permitted as witnesses in courts and statements of children, extremely old, diseased persons and the weak-minded were not admissible as testimony. Furthermore, damaging medicinal plants was punishable and numerous sexual matters were brought under law. In ancient Persia laws dealt with public health matters. Criminal abortion was heavily punished. Injuries were classified into seven groups from simple ecchymosis to mortal wounds. In ancient Greece, dead bodies were considered sacred hence

autopsies were generally discouraged. Records of plant poisons (*Cannabis*, *Datura* etc.) are available and contributions made by scholars such as Hippocrates, Aristotle and Archimedes are notable. Hippocrates (460-355 BC) contributed immensely to medical ethics [4-5] (confidentiality, professional secrecy, abortion, doctor-patient relationship etc.) Aristotle (384-322 BC) fixed the animation of the foetus at the 40th day after conception. He advocated on population limitation by induced abortion before the 40th day and also believed that law should prevent rearing of deformed children. Archimedes (287-212 BC) assisted the king to solve the issue of fraudulently alloying his crown by a goldsmith which gives an early example of application of forensic science for day-to-day matters.

Evidence of application of forensic pathology is found from ancient Rome as well. Numa Pompilius (around 600 BC) authorized that bodies of women dying during confinement should be immediately opened to save the child. Lex Aquillia (572 BC) mandates the assessment of the gravity/lethality of wounds-requiring expert medical opinion. It also talks about *novus actus interveniens* in relation to deaths from wounds. The XII Tables (Lex Duodecim Tabularum)(449 BC) constituted a binding legal code and set a period of 300 days as extreme duration of gestation (in deciding legitimacy) [6]. In addition, civil rights of a child in utero, recognition of the incapacity of the insane and their guardianship, controlling of the disposal of the corpses, diminished criminal responsibility for the under-aged were some other aspects of forensic medicine and pathology addressed in the 'Twelve Tables'. In ancient Rome, investigators of murder were selected from citizens and the father was allowed to kill a gravely deformed child. Lex Cornelia (138-78 BC) imposed heavy penalties on prescribing aphrodisiac or abortifacient agents. Prostitution was to be supervised in this era. Pregnancy was to be proved by five midwives and physicians were held responsible for causing death of their patients. It is stated that Scipio Africanus and Julius Caesar were both born by caesarean sections [7] and when Julius Caesar (100-44 BC) was murdered, his body was exposed in the Forum, Antistius the physician claimed that only one of the twenty-three wounds was fatal, entering the chest cavity. Pliny the Elder (A.D. 23-79) discussed about super-foetation, laws to punish ignorant physicians, suspended animation, sudden natural deaths, suicide and

age of menopause. During the era of the Emperor Justinian I (A.D. 483-565), diffuse materials of law were compiled and united in to a 'Corpus Juris Civilis' (Codex Justinianus) [8]. This clearly shows the place of physician before law. It recognizes physicians as expert witnesses stating 'physicians are not ordinary witnesses, but give judgment rather than testimony'. In the Code, numerous medico-legal matters including (but not limited to) proof of pregnancy, time of delivery, sterility, impotence, abortion, legitimacy, rape, poisoning, mental illness, marriage, simulation of disease etc. had been discussed which gives a strong evidence that physicians may have rendered their assistance in framing the above laws.

2. DARK AGES: (5TH -10TH CENTURIES)

Charlemagne (742-814) (1st Holy Roman Emperor) mandated that expert medical testimony should be called upon in wounding, abortion, rape, incest, infanticide and suicide [9]. Pope Innocent iii in 1209, formalized the influence of the Church by appointment of physicians to the courts during this period. In addition, George, the Bishop of Bamberg proclaimed a Penal Code in 1507 mandating medical evidence in certain offences. *Constitutio Criminalis Carolina* published in 1553 by German Emperor Charles V had paved the path for legal medicine to originate as a specialty and it made expert medical testimony a requirement rather than an option.

3. AUTOPSIES, MORBID ANATOMY AND SCIENCE

Animal autopsies were performed in Babylon as far back as in 4000 BC and the first human autopsies had been performed in ancient Egypt (3000 BC). Although Hippocrates's 'Humoral theory' of disease (imbalance of black bile, yellow bile, phlegm and blood) discouraged autopsies, Egyptian Pharaoh Ptolemy-I Soter (367-282 BC) supported pathological anatomy and established the University and Library at Alexandria. The Greek physician Herophilos of Chalcedon [10] (335-280 BC) who is considered as the 1st anatomist performed human autopsies in Alexandria and compiled a treatise on human anatomy [11]. Erasistratus (310-250 BC) denied humoral theory arguing that diseases origin from changes in organs [12]. Evidence shows that Antistius examined Julius Caesar's body in 44 BC [13]. Galen of Pergamon (A.D.131-201) correlated symptoms with examination findings of

the affected area and he compiled a written text book on human body.

During the middle ages in the Europe, autopsies become forbidden (by the Church). However, Ibn Zuhr (1091-1161 A.D.) who is considered as the father of experimental surgery, performed dissections and autopsies on humans (and animals too) when they were a major taboo. Holy Roman Emperor Frederick II legally authorized human dissections in 1231 A.D., allowing receipt of bodies of executed criminals by the medical schools [14]. Song Ci (1247 A.D.) wrote an instruction manual (Hsi Yuan Lu '*the washing away of wrongs*') on medico-legal investigations determining time and cause of death, poisoning, decomposition, wounds, weapons, strangulations etc. In addition, Muslim physicians investigating infectious diseases in Asia have also contributed significantly towards the development of pathology. Throughout the Renaissance, anatomy teachers and students gathered around dissection tables watching 'lay dissectors' opening and dissecting cadavers. Among them were Leonardo da Vinci and Michelangelo thus performing a number of autopsies as anatomy demonstrations. Antonio Benivieni (1443-1502), a Florentine physician, one of the founders of pathological anatomy, published '*The hidden causes of disease*' in 1507 strengthening the study of morbid anatomy. In 1533, the first autopsy of the New World occurs when the Catholic Church ordered the post-mortem examination of the conjoined twins Joana and Melchiora who died on the 8th day after birth to find the 'number of souls' they had! [15] In 1543 anatomy professor Andreas Vesalius published 7 volumes on human anatomy disproving the theory of four humours. In 1679 Theophile Bonet published a complete organized anthology discussing 3000 autopsies classifying the dissections by disease and symptoms paving the groundwork for Morgagni to continue on his work. In 1607 AD, the Penal Code of the Bishop of Bamberg officially recognized Forensic Medicine as a separate entity [16]. Professorships of legal medicine were founded for the first time by the German government in 1720 AD. In 1751 British Parliament enacted the Murder Act including a provision for public dissection. Giovanni Battista Morgagni (1682-1771) in 1761 wrote the first and most famous pathology text book; '*On The Seats And Causes Of Diseases Investigated By Anatomy*'. His work accredited him as the 'father of morbid anatomy.' In England, William Hunter (1718-1783) and John Hunter (1728-1793) established the first

English museum of pathology. In 1807, Great Britain included Forensic Medicine in the medical curriculum and the first Chair of Forensic Medicine was founded at the University of Edinburgh. In Sri Lanka, Forensic Medicine was included in the medical curriculum right from the inception of the Colombo Medical School in 1870. Matthew Baillie in 1793, published the first atlas of pathology. Paul Revere in 1775 makes the first forensic dental identification of his friend Dr. Joseph Warren who was killed in the battle of Bunker Hill [17]. French physician Xavier Bichat honoured as the father of histology and tissue pathology, in 1800 looked deeper into the organs to describe 21 different types of tissues comprising organs [18].

Karl Rokitansky performed over 30,000 autopsies and supervised over 70,000 during 45 years of his career and he introduced the methodical "Rokitansky" approach of evisceration. In 1821, Napoleon Bonaparte requested an autopsy as his dying wish which was performed by his personal physician Francesco Antommarchi to discover a gastric cancer. During 1827-28 William Burke and William Hare teamed up to kill 16 people in Scotland to provide cadavers to Dr. Robert Knox [19]. In 1832 British Parliament passed the Anatomy Act authorizing dissection of donated bodies by members of medical profession. One of the first celebrated cases in forensic science involved the 'father of toxicology', Mathieu Orfila (1787-1853), who worked in Paris and testified in an arsenic poisoning criminal trial in 1840. Orfila and others had developed a chemical test to detect arsenic, the poison of choice for the period because the symptoms of violent stomach pains and vomiting were similar to cholera - a common disease of the times - and often went undetected. Orfila is considered as the pioneer in attempting to bring chemistry in to forensic investigations [20]. In 1865 the autopsy of the assassinated US president Abraham Lincoln was performed at the White House by army surgeons. German pathologist Rudolf Virchow (1812-1902) emphasized on the importance of autopsy in the understanding of disease and pathology. He used light microscope to uncover minute details not visible to the naked eye. In 1902, Dr Dorothy Reed Mendenhall, working for the John Hopkins Laboratories, partly through analysing autopsies, discovered that Hodgkin's disease is not a form of tuberculosis but a 'blood cell disorder' [21]. Alphonse Bertillon's (1853-1914) personal identification system was developed in 1882 using a series of body and facial measurements

for individualization. Dr. Francis Galton's (1822-1911) '*Fingerprints*', published in 1892, was another pioneering contribution to the emerging field of forensic science. Alexandre Lacassagne (1844-1921) emphasized the importance of striations on a bullet in the definite identification of the weapon. The first forensic laboratory was set up in Lyon, France in 1910 by Dr. Edmond Locard (1877-1966) [22]. The first crime laboratory in the U.S. was established in 1930 by the Los Angeles County Sheriff's Department. The Federal Bureau of Investigation (FBI) lab was established in 1932 and in 1937 Paul Kirk (1902-1970) set up the first academic criminalistics program in the U.S. at the University of California.

4. FORENSIC PATHOLOGY TODAY

Prior to the 18th century, forensic autopsies were the exception rather than the rule. Until the dawn of the 19th century, even a significant number of homicide trials were concluded without an autopsy or in the absence of evidence of an expert medical witness. Proportion of deaths subjected to autopsy differs from country to country while religious and cultural beliefs/practices in certain regions are accountable to low autopsy rates. In the USA, Canada, England, Australia and most of the countries in the continental Europe, forensic pathology and clinical forensic medicine are practiced by two different medical personnel- forensic pathologist/police surgeon and forensic clinicians respectively. However, in India, Sri Lanka, Switzerland etc., the same medical specialist practices both. Forensic pathologists are specialists with a background in histopathology or anatomical pathology. They practice principally under the Coronial death investigation system or Medical examiner system. Some countries have a combined/intermediate system. Numerous deficiencies in the Coroner system have been identified and many reforms have been brought about. The forensic pathologist's pathology skills are supported by the ability to integrate medical aspects of the case with associated toxicological, scientific and legal issues. They are employed in the state health sector, higher education institutes (university forensic departments) or solely in private sector. The forensic pathologist is expected to address the salient medico-legal issues pertaining to the type of death he investigates. The case variation is immense ranging from a single identified fresh intact body died of some deducible cause to multiple

comingled human and animal remains in unknown/ill-defined burial sites due to surreptitious disposal following extra judicial executions at different times and by different means. His approach usually consists of history taking, scene examination, autopsy with different levels of investigations/laboratory tests, integration and interpretation of medical and other scientific findings, compiling report, participation in pre-trial conferences (only in certain jurisdictions) and attending courts as an expert witness. They are generally expected to be independent, unbiased and uninfluenced by political or any other pressure or duress, as well as not concerned about the outcome of the trial. A forensic pathologist may be expected to have some special knowledge in anatomy, histopathology, toxicology, clinical forensic medicine, immunology, microbiology, odontology, anthropology and chemical pathology etc. The case load differs from country to country and in the same country from region to region. The same is true for the case variety. Usually, approximately 80% of the cases are natural deaths though this condition is skewed due to variety of reasons such as epidemics, war, ethnic conflicts, natural disasters etc. in certain regions of the globe.

Facilities and available investigations differ from country to country and in the same country from institution to institution. In certain regions in the world autopsies are done with bare minimal facilities and investigations. On the other hand, there are state of the art type of centres with the cutting edge of technology such as the Victorian Institute of Forensic Medicine (VIFM) in Australia and Forensic Services and Coroner's Complex, Toronto, Ontario. It is generally accepted that a forensic autopsy without histopathological examinations is an insufficient autopsy though a significant number of autopsies are still being done without routine histology. Different centres adopt different routine protocols-they change in the context of approaches and investigations. Some adopt special protocols to suit special circumstances-paediatric autopsy, high risk autopsy, putrefied autopsy, special neuropathological autopsy, barotraumas, unidentified bodies/Disaster Victim Identification (DVI), skeletal remains, maternal deaths etc. In some centres, sub-specialists are employed for special purposes. (paediatric forensic pathologists, forensic neuropathologists, 'necro-radiologists', aviation pathologists etc.) [23]

Though forensic pathology is initially considered as a sub-specialty of pathology, more and more sub-specialties of forensic pathology itself are emerging since recent times. Furthermore, influx of new knowledge and technology from allied sciences (toxicology, anthropology, radiology/imaging techniques, odontology, computer science, chemistry, biology, molecular biology, DNA, Nano-technology etc.) is becoming a challenge to the conventional forensic pathologist. Thus, the integrity and the boundaries as well as the role and the scope of Forensic Pathology are constantly and dynamically changing. It is also merging with clinical forensic medicine than ever before. Forensic pathology practice is becoming more globalized and transparent. Isolated practices and the concepts of "Gurus" and "masters of all" are rapidly dwindling. Second opinions are sought voluntarily for personal and professional development. More and more auditing is being done. International collaboration is sought in DVIs and missions related to missing persons where teams of forensic pathologists work alongside other forensic specialists. DVI missions conducted in the former Yugoslavia, Rwanda, East Timor etc. provide classic examples. In certain centres, different approaches are employed depending on the complexity of the case such as routine full autopsy, full autopsy with extended investigations, full autopsy with additional dissections, limited autopsy, external examination with one blood sample, virtual autopsy etc.

In the modern world of technological advancement, there are numerous sophisticated methods and instruments in the bio-medical field for identifying pathological processes and arriving at diagnosis of disease conditions. Despite advanced technology in the field of medical diagnostics, to date, the autopsy has remained the gold-standard method to understand the biological features, pathological processes and pathogenesis of unknown infections, especially when awareness of a pathogen is restricted and the impact of the same on the healthcare system is substantial. The knowledge gained through this technique has positively influenced therapeutic strategies and overall understanding of the pathogen, ultimately reducing mortality. Contribution of autopsy in the advancement of our understanding of the pathological processes associated with cerebral malaria and dengue are historical examples. This fact is confirmed by

several studies done in Italy. This study discusses about an overview of autopsy in the three types of coronaviruses (SARS-CoV, MERS-CoV, SARS-CoV-2) over the past two decades, highlighting the pivotal role of autopsy in the management of unknown diseases. In all cases, autopsy provided much information about each unknown/little-known coronavirus [24] [25]. Among those coronaviruses SARS-CoV-2 has become a pandemic today. Other than details of a pathogen and disease transmission, safest method for disposal of samples and dead bodies is also determined by the extensive analysis of findings of the autopsies [26]. Even for collecting the details of the variation of transmissions and pathology with the change of the virus types, further autopsy analysis has a greater potential value [27].

5. NEW CHALLENGES

In certain countries, the extent of forensic pathology services is declining. The need arises here to include forensic medicine into the undergraduate medical curriculum (e.g. the UK). In certain other countries, the forensic pathology services as well as the number of specialist pathologists are steadily increasing (e.g. India, Sri Lanka) Here, expecting an extensive knowledge in forensic medicine from a medical undergraduate is no longer justifiable as routine forensic work island-wide could be carried out under the supervision of consultants.

Advanced technology and sophisticated instruments have undoubtedly improved the accountability of the discipline. Yet, forensic pathology faces new challenges in the modern era. New trends in crimes specially associated with technology are emerging. Use of recreational drugs and abuse of therapeutic agents are becoming more and more complicated. Disease patterns and non-communicable disorders are constantly changing. Pathologists are expected to cater a more sophisticated and better-informed public due to the changing expectations of the victims and families. The demand by the general public for less invasive autopsy is increasing and the criminal justice system is expecting a more evidence-based approach from the forensic pathologist.

6. NEW ADVANCES AND THE FUTURE

Technology will obscure the boundaries and identity of forensic pathology as a distinct entity

by compelling it to merge with rest of the allied sciences. Few of the many recent advances with promising future outcomes are forensic imaging/virtual autopsy, laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), alternative light photography, high-speed ballistics photography, video-spectral comparator, digital surveillance device, 3D facial reconstruction, DNA sequences, forensic Carbon-14 dating, magnetic fingerprinting and automated fingerprint identification (AFIS), Link analysis software for financial fraud, portable forensic labs, smart algorithms to catch criminals, pre crime policing and Nano-forensics.

7. ROLE OF MIRNAS IN FORENSIC SCIENCE AND IN TOXICOLOGICAL INVESTIGATIONS

mRNA-analysis has become a well-established technique in many forensic laboratories. Micro-RNA technology came after that. Analysis of miRNA and perhaps small non-coding RNAs in general clearly have potential for forensic applications and merits attention of forensic scientist [28][29]. Over the last few years, the development of MicroRNA (miRNA) technologies have become an essential part of research projects and their role as potential molecular biomarkers is being investigated by the scientific community. The circulating miRNA detection as a diagnostic or prognostic tool for the diagnosis and treatment of certain diseases is quite noteworthy. Furthermore, miRNAs remain stable both at room temperatures as well as during freeze-thaw cycles. These characteristics highlight the important potential of miRNAs in the near future as new tools for anti-doping. A study done in Italy to analyse the "miRNA signature" use as biomarkers for health disorders, is focussed on the organ damages related to AAS use/abuse [30].

In forensic toxicology, gold, silver and titanium oxide Nano-particles are commonly used to enhance the detection limits of toxic material from biological samples including skeletal samples [31]. The use of microfluidic devices and microfluidic chip technology in DNA analysis provides the advantages of shorter examination time, lesser contamination risk and being directly applicable at the crime scene. In forensic DNA typing, silica and copper based magnetic nanoparticles are used to extract DNA samples for PCR. To isolate DNA, magnetite nanoparticles with carboxylic compounds are used as absorbents for PCR amplification.

In terms of fingerprint visualization, Aluminium or carbon containing powders are conventionally used to visualize latent prints [32]. Gold Nano particles target amino acids in sweat of prints and sun creams/body lotions are detected with Titanium dioxide /zinc oxide Nano particles. In order to detect explosives, electronic noses with chemical sensing systems, Nano tubes and Nano-mechanical systems are used to detect plastic explosives, bombs and grenades. This is less expensive and more accurate than sniff-dogs. It also can assist sniff-dogs. Furthermore, Nano technology together with high resolution SEM and X-ray spectrometry are used to detect and analyse minute traces of explosives and gunshot residues. Nano-technology further enhances the utility of Electron Microscopy, Atomic Force Microscopy (AFM), Dynamic Light Scattering (DLS) and Raman Micro Spectroscopy [33].

8. FORENSIC IMAGING AND VIRTUAL AUTOPSY

Digital imaging methods used increasingly in modern post-mortem investigations are collectively termed 'post-mortem imaging'. Radiological imaging is as old as radiology itself. Wilhelm Rontgen discovered X-ray in 1895 and a mummified hand of an Egyptian princess was X-rayed in 1896 [34]. Today (in addition to X-ray) imaging techniques used in forensic investigations include Post Mortem CT, Post Mortem CT Angiography /M-PMCTA, Post Mortem MR, Photogrammetry and 3DSS. These techniques have their own advantages and drawbacks. They all allow digitalization of data in retrievable form and leave a permanent record. Each modality visualizes different parts of the body optimally; e.g. skeletal system (PMCT), vascular system (PMCTA), soft tissues/infants (PMMR), body surface (3DSS/Photogrammetry). By using these techniques together on the same body, most components of the body could be satisfactorily visualized. M-PMCTA is the method of post-mortem angiography established by Prof. Silke Grabherr (Lousanne and Geneve University) and Fumedica, the medical device manufacturer in Switzerland [35]. Today these 5 major imaging techniques are mostly used independent of one another to enhance and supplement the outcome of conventional autopsy dissections. Modality is chosen according to the circumstances/particulars of the case to increase sensitivity and reliability and the existing technology is impressive as far as the resolution, rapidity and practicality are concerned. But the

biggest challenge lies in the accurate interpretation and correlation of the findings.

Virtual autopsy is resorting to forensic imaging techniques as an alternative to conventional autopsy. All words; Virtopsy/Virtobot/Virtangio are coined by and trademark-registered to Prof. R. Dirnhofer of the University of Bern, Switzerland. With Prof. Michael Thali as operative head, Virtopsy research team operates from the University of Zurich [36]. Some advantages of a virtual autopsy are preservation of the body (in virtual form), documentation of finding in an 'observer independent' manner, complete non-destructive gathering of the findings of the entire body, data acquisition in parts of body where it is difficult to gather through conventional dissections and where it grossly disfigures the body by dissection (e.g. cranio-maxillo-facial trauma), data acquisition of regions difficult to dissect (e.g. atlanto-occipital joints) and in advanced putrefaction [37]. Virtual autopsy also provides better visualization of the cardio vascular system. Replacement of manual dexterity by 'virtual knife' of the automatic sectional imaging technique poses no health hazard to the pathologist and the assistant. In addition, virtual autopsy allows contamination-free and highly precise sampling. Permanent record of findings in retrievable form improves quality of forensic reports, simplifies seeking second opinion and improves comprehensibility of the reports to the non-medical audiences (lawyers, judge, jury). It also provides better acceptance by relatives and religious communities.

However, virtual autopsy do have certain disadvantages and limitations such as high equipment cost (to establish, maintain and perform autopsies) and limitations of radiology (metal, foreign objects pose difficulty, colour and colour changes of internal organs [38], pathological conditions such as oedema, inflammation, infective status, post-mortem artefacts, differentiation between ante and post mortem injuries are difficult to be appreciated). Limitations of surface scanning (recording curvatures, recording reflective or transparent area such as eyes, the need to rotate the body for total body recording) too are applicable as drawbacks or difficulties in virtual autopsy. Near total reliance on imaging alone and their interpretation by a radiologist who may not be a specialist in forensic medicine/pathology is another limitation in virtual autopsy. In addition, certain purely histopathological diagnoses may

be missed and the objectivity (whether experts are consistent) and the validity (validation of methods using closely prepared prospective studies) have not yet been sufficiently done [39].

9. CONCLUSION

The history of Forensic pathology is intimately intertwined with human culture and civilization and its ultimate goal is aiding execution of justice thereby assisting to promote human dignity. The conventional role and scope of forensic pathology are constantly and dynamically changing. As a generalization it is highly acceptable to utilize and incorporate new techniques alongside with conventional autopsy to improve the quality, reliability, acceptability and reproducibility of the outcome but the limitations of the new techniques should be born in mind before using them as the exclusive method of death investigation.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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