

THE AUTOPSY – THE ULTIMATE MEDICAL CONSULTATION

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"To practice pathology without books is to sail uncharted seas; to practice pathology without autopsies is not to go to sea at all."

Sir William Osler

It has been long recognised that the autopsy examination plays an important, critical and multifaceted role in medicine. A valuable cornerstone in the study of disease processes, it functions as an important peer review mechanism for medical and surgical care is an unrivalled teaching exercise and an invaluable research tool. Its considerable usefulness has been well-documented.¹⁻⁶ It is surprising, therefore, that autopsy rates worldwide continue to decline.⁷ In 1984, the House of Delegates of the American Medical Association reaffirmed the importance of autopsies as a vital quality assurance measure within the health services program.⁷

The purpose of this paper is to outline the role of autopsies in medical practice and health policy, detail the nature and reason for the declining rates of autopsy and to suggest remedial trends to halt or reverse these trends.

The role of the Autopsy

The following is a condensation of the role of autopsy in medical practice and health policy formulation.

1. Quality Control of clinical care.

Since the time of Morgagni,⁸ autopsy rates have served as an effective approach to the assessment of quality of medical care.

Firstly, autopsies provide confirmation, clarification and correction of antemortem clinical diagnosis. Review of the available literature published on the extent of inaccurate or missed clinical diagnoses uncovered at autopsy is revealing.⁹⁻¹¹

In a prospective survey of 1000 necropsies, Cameron *et al* discovered that the main clinical diagnosis was not confirmed in 39% of cases.²

Gambino¹³ reviewing 428 autopsies over a 4½ year period (1978 – 1982) concluded that in 48% of cases, autopsy examination contributed to improvement in medical care.

In 15.6% of cases, diagnoses were either missed or made erroneously, and these findings are similar to that of Goldman¹⁴ and associates, who found major missed diagnoses in 22% of cases. They classified missed diagnosis as follows: Class I errors were missed major diagnosis with adverse impact on survival; Class II, missed major diagnosis with equivocal impact on survival (no definite treatment available, treatment appropriate even though condition was misdiagnosed); Class III, missed minor diagnosis related to terminal disease processes but not directly related to death; Class IV, missed minor diagnosis that were either (a) important unrelated diagnosis that may have eventually affected prognosis or (b) processes that contributed to death in a terminally ill patient. In Goldman's study all Classes of errors probably accounted for approximately 20–60% of all autopsies performed.

Interestingly, however, the percentages of cases with undiagnosed primary causes of death (Class I errors) have remained constant throughout the decades, remaining fixed at a magical figure of about 10%.¹

Notwithstanding the constancy of occurrence of Class I errors over the eras, the pattern of missed diagnosis has changed. In the early 20s, bacterial pneumonias, hepatic cirrhosis and common tumours figured conspicuously among the conditions most commonly missed clinically but detected at post-mortem.¹⁵ Later, bacterial endocarditis, meningitis and intracranial neoplasms figured conspicuously.¹⁶ At the present time, it appears that pulmonary embolism, and new and novel infections occurring in the background of immunosuppression seem to be the prominent missed conditions.^{17,18} In this present age when the medical profession is inundated with a profusion of technological wonders and successful instrumentation, there is a growing tendency for clinicians to believe that these newer (but not necessarily better) modalities of diagnosis (often non-interventive) are sufficient to eschew the need for a tissue diagnosis.

The extreme sophistication of these newer diagnostic modalities has led to escalation in

medical costs and paradoxically, the medical profession in the midst of this technological plenty, is weaker and poorer in a rather different way. There has been a gradual erosion in the public trust in doctors; physicians are being perceived as serving their own interests, not the patient's; conflicts of interests are rife. Postmortem rates are lowest in nursing homes or institutions caring for the terminally ill. General disinterest and lack of incentive lead to a deterioration in patient care. Valuable autopsy information could ultimately contribute to more effective supportive therapy for terminally ill cases.

A correctly performed autopsy is the ultimate control of quality assurance in the health-care system and a thriving autopsy practice serves the community as the ultimate standard of public good.

2. *Undergraduate teaching and continuing medical education*

In an academic institution, the autopsy services contribute to continuing education of professionals. Seminar teaching in undergraduate and postgraduate education requires extensive morphological data and statistics on diseases garnered largely from autopsy examinations. Indeed autopsy provides information on disease manifestations which cannot be provided by living subjects, for example in a whole host of neurological and cardiogenic disorders.

There are medical and epidemiological research contributions. Autopsy is of proven value in elucidating some of the important aspects of certain neurological diseases. A case in point is Alzheimer's disease – autopsy and detailed neurological investigation remain the most valuable way to diagnose it. Other degenerative brain disorders such as Pick's disease of the brain for example, are also studied better this way.

Autopsies are more difficult to perform today than they were 25 years ago.¹⁹ There is a need to interpret injury to tissue produced by the natural biology of the disease, and also to correlate the effects of numerous therapeutic modalities – drugs of every kind, numerous opportunistic organisms, complex problems arising from extraordinary surgical procedures, effects of prostheses, graft rejection and many more.

3. *Discovery of new or previously unrecognized diseases*

In patient care the description of new diseases and the evaluation of old diseases

must continue to form an essential part of medicine.

The enigma of several diseases have been uncovered because of the painstaking efforts of committed prosecutors – the entities of asymmetric hypertrophy of myocardial septum, post-partum hypopituitarism or Sheehan's Syndrome, Zollinger-Ellison Syndrome, Toxic Shock Syndrome, Whipple's disease, Legionnaires' disease, the pathophysiology of carotid and vertebrobasilar insufficiency, alveolar proteinosis, diethylene-induced renal damage, the phenomenon of metastasizing carcinoid.^{20,21} To this list we may add veno-occlusive disease of the lung and liver, the association of hepatic cirrhosis and alpha-1-antitrypsin deficiency, oxygen excess and retrolental fibroplasia, the pathology of industrial pneumoconiosis, radiation-induced injury, the consequences of immunosuppression engendering opportunistic infections and malignancies – lymphomas/leukaemias and cancers of the skin and thyroid. Our understanding of the pathology of the Acquired Immune Deficiency Syndrome (AIDS) and the AIDS-related complex has been greatly enhanced by careful study of autopsy material. It allows for evaluation of new surgical techniques, such as the evaluation of prostheses in cardiac and orthopaedic surgery.²²

Observations on the deterioration of replacement cardiac valves, for instance, helped in the development of better ones. Autopsy plays a role in the evaluation of the efficacy of new drugs and potential adverse effects.³⁻²⁵ Indeed pharmaceutical companies should promote the concept that increasing autopsy rates result in the accumulation of a large and adequate database on adverse drug reactions.

4. *The investigation of environmental, social and transcultural disease*

The availability of reliable autopsy data is of particular importance in guaranteeing the accuracy of any available database and permits the continuation of extensive epidemiological research of national and international importance.²⁶

From the public health viewpoint, the autopsy examination provides accurate information as regards cause of death and this facilitates the process of hypothesis generation and testing concerning temporal and spatial prevalence of a disease.

Careful autopsy studies have aided immensely in the investigation of environmental, occupational and life-style related

disease. The pathology of many industrial diseases such as asbestosis, berylliosis, silicosis and the extrinsic allergic pulmonary afflictions (such as silofiller's lung) have been clarified by tissue obtained at autopsy. The accumulation of meaningful autopsy data allows for comparison of inter and intracultural and geographical aspects of a disease entity.

The detection of chronic, long-term delayed and/or subclinical effects of ingestion, inhalation and absorption of industrial toxins (such as organochlorine pesticides and radioactive wastes) and of new chemicals in the workspace and general environment, soil, air, water, commercial products, food additives and contaminants has been made possible as a result of meticulous autopsy examination.²⁷⁻³¹

Paleopathology is an new and exciting offshoot, and together with the development of its sister disciplines of palaeo-biochemistry, -serology and -immunology, is poised to unravel the secrets of diseases present in the Ancient

5. Reassurance and family counselling

The postmortem examination may indeed be beneficial to the deceased's family – it may provide information on the presence or absence of congenital or contagious disease, be of value in determining insurance benefits or double indemnity claims in cases of accidental deaths; it may be a source of comfort by absolving the immediate family members of lingering feelings of guilt.

6. Autopsy and the law

Autopsies are mandatory in cases of sudden, suspicious or unexplained deaths – not merely as part of an investigation for criminal offences but also to identify medical conditions with no antemortem manifestations such as the sudden infant death syndrome (SIDS) or sudden cardiac death.

During the course of a forensic postmortem, a prosecutor may be able to establish the cause and time of death, the circumstances preceding or surrounding death and with investigation may be able to establish the mechanism of death.

7. Accuracy of death certification

A medical database system is valuable; among other things, it presents incidences and locations of different causes of death, provides valuable data on crime-related deaths, suicides and accidents with feedback on possible prevention. It allows for suspicion to be generated so that hazardous materials may be identified and lastly, monitors the

effectiveness of preventive methods.

The autopsy is a standard used to verify the diagnosis of death certification and provides an estimate of its validity. It is a yardstick for estimating the sensitivity and specificity rates of diagnostic procedures.

8. Evaluation of diagnostic tests and technologies

The clinicians' love affair with the "new technology" has been paralleled by a waning interest and lack of appreciation for autopsies. However the "gold standard" by which these largely indirect procedures are ultimately evaluated and their results understood is the careful clinicopathological consultation conducted at autopsy.

The autopsy plays a special role in the assessment of major new diagnostic technologies such as the Computerized Tomography (CT), Nuclear Magnetic Resonance Imaging (NMR), Positron-Emission Tomography (PET). These new modalities require significant resource commitment. However, effective utilization requires among other factors, a precise assessment of their diagnostic accuracy.^{33, 34}

In a recent study on the influence of technological advances on diagnostic accuracy, ultrasound and CT appeared to be more likely to provide misleading results than other types of procedures.¹⁴

Gambino *et al*¹³ discovered that 4.4% of autopsy studies "disclosed errors in the result of various diagnostic tests including ultrasound, nuclear scans and blood chemistry analyses."

Longoni *et al*³⁵ compared results of magnetic resonance imaging with autopsy and concluded that imaging techniques are prone to error in diagnosing infections, especially pneumonia.

A valuable purpose of autopsy in this instance is through a process of constructive feedback, attempt to reduce and maintain diagnostic error at an acceptable minimum level, by identifying non-random characteristics of error whether attributable to specific diagnostic technologies, particular equipment or certain diseases. It is highly conceivable that new technologies can be used to streamline, refine and update autopsy procedure and strengthen its potential for validating research studies or identifying new diseases.

9. Provision of tissue

With all the inherent problems of procuring

live human tissue for transplantation, grafting or hormone replacement therapy, it is unwise to disregard the potentially rich source of organs and tissue which may be harvested in the cause of the autopsy examination. Tissue such as the kidneys, bone marrow, vascular conduits, dura, pituitary, muscle from diaphragm or psoas, fascia, trachea and middle ear are tissue that lend themselves admirably to these ends.

10. Epidemiological research contributions

Necropsy information may affirm that certain diseases are now on the decline, such as syphilis and other treatable infectious diseases. The information derived thereat allows for evaluation of prevalence trends/hypotheses testing for risk factors in disease etiology. For an effective epidemiological program project, there should be a suitably high autopsy rate (at least 65% or more) to preserve the integrity and uniqueness of the survey.

It seems in some ways tragic that pathologists have neglected the rich natural first resource of autopsy-derived organs and tissues for novel and new methods of research. Human research in cell and developmental biology, infectious disease, molecular biology and endocrinology has taken us into the entrancing world of immunochemistry, marker studies, immunoelectronmicroscopy and genetic probing. It has been left to workers in other disciplines to report on the statistical, biochemical, physiological and pathological features of diseases as varied as lupus, diabetes, myocardial infarction and Alzheimer's disease.

The nature of and reasons for the decline of autopsy rates

The historical origins of the value of autopsy findings harken back to the 19th century, when such information gleaned from postmortem examination enhanced the understanding of disease and, furthermore, played a vital role in the discovery of new diseases. It formed an indispensable component of medical education, serving as an evaluative measure of the efficacy of treatment regimes.

In the mid-50s, the increasing reliance of experimentation as a method of acquisition of new medical knowledge led to a gradual shift in emphasis, fostering a decline in interest in the post-mortem examination.

This trend was to continue through the 60s, until by the mid-70s, over a twenty year period, autopsy rates in three continents had declined from an average of 50% to between

10 – 15%.^{7,12,14,36} At the present time, with the possible exception of Austria, Finland and some of the Eastern European nations, there has been a general decline in autopsy rates worldwide.³⁷ Over a 15 year period between 1970 – 1984, the number of hospital autopsies (non-medicolegal cases) in the University Hospital, Kuala Lumpur declined from 28% to a mere 12%.⁴

Against this background of declining autopsy rates, the nature of cases for which such examination was performed has also changed; autopsies tend to be skewed in favor of cases of a medicolegal nature. In the Malaysian context at least, the vast majority of cases in peripheral district and general hospitals tend to be of such a nature. The figures from teaching hospitals are not much different either.⁴ In addition, autopsy rates tend to vary depending on the age groups studied as well as the place of occurrence of death. There tend to be abnormally low autopsy rates for elderly persons. In this country, outside academic departments of Pathology, perinatal postmortem examinations are almost never performed (Personal observations).

Some worthwhile considerations on the decline of autopsy rates are: the availability of fine-needle and non-invasive biopsy techniques and the coming of age of exfoliative cytology and non-invasive radiology has allowed a conclusive diagnosis to be reached during the course of a patient's hospital stay – fewer are the instances of clinical doubt surrounding a patient's illness. The prevailing trend of depersonalization of medical care has resulted in communication barriers between clinicians and relatives of the deceased, and the need for a postmortem examination (when such an occasion presents itself) may not be clearly explained; consent for examination may thus be denied. This has led to a general reluctance to push for autopsy. In some parts of the world, the looming threat of malpractice liability and the fear of litigation or professional embarrassment from undiagnosed and unsuspected conditions surfacing in the course of a postmortem examination may be another disincentive; this, despite the fact that available scientific literature seems to imply instead that autopsy is more commonly used as a defence against suits rather than as a cause for litigation.³⁸ It has been suggested that improved quality control of medicare will ultimately lower the number of malpractice awards.³⁹

Pathologists may not be without fault either: they may be less than enthusiastic when

confronted with a request for autopsy examination or may be uncommunicative of their findings to both clinicians and immediate family members. Indeed, poorly performed postmortems are arguably worse than no post-mortem at all, and a belligerent, unenthusiastic and generally unprofessional attitude by the attending pathologist may heighten the clinicians' disinclination to seek such services in future. Delegation of the autopsy to technicians or ill-experienced disinterested trainees, the perfunctory performance of autopsies, the lack of detail and incompleteness of reports are compounding factors. Morticians, with a vested commercial interest in a rapid turnover of bodies, may impose their will on the bereaved, influencing them into refusing consent for postmortem examination, in an attempt to "clinch a deal".

Socio-cultural reasons are undoubtedly a factor as well, at least in the local context. Fear of disfigurement or putrefaction, reverence for the dead proscribing undue "tampering with the remains", and miscellaneous religious taboos may be operative in contributing to declining rates. Islam, in general, forbids the removal of organs or disfigurement of the dead.⁴⁰ Indeed, in many Muslim countries, or in the case of Orthodox Jews, it may not be possible to perform an autopsy, except where civil law prevails.

Ultimately, the reasons for the decline in autopsy rates are rooted in the laissez faire attitude of the medical profession at large — the lack of support from organized pathology groups and societies, the governing bodies for accreditation of hospitals, medical school curricula committees, hospital administrators, the Departments of National Statistics and the general health community.

In the United States the Joint Commission for the Accreditation of Hospitals (JCAH), in 1973, abolished the need for a minimum autopsy rate (originally proposed at 20–25%) for accreditation of hospitals.⁴¹ This has almost certainly hastened the fall of already declining autopsy rates.

Sadly, methods of medical education no longer emphasize autopsy as a learning experience. There is a crying need to update and standardize autopsy techniques for integration with education curricula and research. Many medical students do no further prosection after an initial course of cadaver dissection as part of Anatomy practicals. The autopsy should provide a focus for clinical studies through the medium of clinicopathological correlation, but the severe underutiliza-

tion of this facility has ultimately affected the motivation of physicians to use postmortem examinations in the course of instruction as well as for their own academic furtherment.

It is of paramount importance to revive interest in postmortem examinations, not only so that more can be performed, but also to upgrade the standard of autopsy performance and to endeavour to extract the maximum information from such a procedure. An effort should be made to promote the use of updated protocols for medical research.

Sufficient numbers of pathologists must be trained and they should possess sufficient knowledge and expertise as well as interest in the procedure. Pathologists owe it to themselves to improve themselves by continuous learning to familiarize themselves with new knowledge and recent techniques of investigations, so that autopsies may be performed with maximum efficiency to gain the utmost information. Clinicians should avail themselves at the time of autopsy to share in the learning and information gathering experience.

In most countries, autopsy services are free (a cadaver is not considered a patient), and there are problems of reimbursement. Autopsy does not generate profits for the hospital and as a non-revenue producing activity autopsy is dispensable when economic pressures require cutbacks. The postmortem is regarded by pathologists as a medical responsibility rather than as a source of income, and it is possible that a method of physician reimbursement for autopsy will reinforce the desirability for postmortem examination and retain autopsy as a medical prerogative. I feel that the autopsy should be regarded as a medical professional service and therefore should be financed accordingly.

In most countries consent from the next of kin is required before a postmortem examination may be performed. A sympathetic clinician conferring with bereaved family members often overcomes whatever initial recalcitrance to autopsy that lingers; expenditure of time and energy in explaining to relatives on the need and usefulness of a postmortem examination is very worthwhile. Alternatively, the system practiced in some Scandinavian countries may be ideal — in all instances of hospital deaths, a postmortem is performed unless family members specify that one is not desired.

Sociocultural resistances are more difficult to erode. Religious organizations can probably play a vital community service in educating the

public. Occasionally, relatives may be prepared to consent to a limited autopsy. The autopsy, of course, need only be limited in the incision made; near total evisceration is possible through a low neck to xiphisternum incision.

Ultimately the answer lies with education and the heightening of general awareness – not only of the general public, but of health as well as government administrators, medical and health personnel, clinicians, pathologists and medical students. The importance of autopsy should be incorporated into medical curricula and made a component of medical examinations. It is probably worth considering seriously the proposal by the Royal College of Physicians and the Royal College of Pathologists of UK that it is reasonable from the quality of care and medical audit viewpoint for a sample of all deaths to be submitted for postmortem examination over and above those that would normally be reported so that hospital autopsy rates would be raised by 20%.⁴

In concluding, I would like to quote from King and Meehan's classic paper, where they stated:

"It is a pernicious misconception that the mere performance of dissections lead to a progress in medical science. Progress depends not on the autopsy but on the person who is examining the material. Those who believe that the more autopsies that we perform the more medical science will progress are pleading not for more autopsies, but for more persons who can profitably utilize the data of autopsies, persons with imagination, originality, persistence, mental acuity, sound education and background, and the indispensably prepared mind. It is a grave disservice to confuse the performance of autopsies with the spark of insight which the autopsy may trigger".⁴

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