

**Pathological Society 2010 Undergraduate Essay Award**

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# **THE AUTOPSY IS DEAD**

## INTRODUCTION

In 1965, Abbiss asked the question if the autopsy was dead. (1) 45 years later, we again find ourselves challenged by the very same notion. The autopsy was previously the focus of modern medicine, playing a crucial role in the discovery, characterization and understanding of the pathological processes of diseases. The autopsy was at the heart of medical research, education and professional development. Doctors felt that the autopsy was central to the advancement of medicine. This was up until the 1960s. (2)

The autopsy rates in the USA have dropped over the decades from 60% prior to the 1960s, to 41% in the 1960s, 22% in the 1970s, and to less than 10% currently. (2, 3) The situation is equally disheartening within the UK. In 1993, the Royal College of Pathologists recommended that at least 10% of hospital deaths should be autopsied for audit purposes. This was later amended in 2002 as it was recognised that hospitals were unable to reach the set target. (2) Autopsies were only carried out 21.9% of the time, and only 0.4% of autopsies were not requested by a coroner. (4) Post mortem rates have consistently demonstrated a downward trend. This has led to doubts over the future of the

autopsy, and we therefore find ourselves faced with the prospect that the autopsy is dead once again.

## WHY THE DECLINE?

It has been commented that “doctors have come to regard the autopsy as a crude and largely outmoded procedure.” (5) The autopsy is seen to only have “a marginal role in contemporary medical practice” and has been “pre-empted by the biopsy and a raft of other less invasive diagnostic techniques.” (5) Therefore, to dismiss the autopsy as dead has a twofold implication. Firstly, that the autopsy has nothing significant to contribute towards medicine. Secondly, that the autopsy is outdated, inflexible and with no potential for improvement. It should be superseded by modern diagnostic techniques. Neither of the above claims can be said to be true of the autopsy. However, there is a need to first understand the reasons behind these claims.

## THE PUBLIC

Many reasons have been attributed to the obvious decline in autopsies. It can firstly be explained by the lower uptake of post mortems by patients’ relatives today. The public’s understanding and impression of post mortems play a huge role in determining consent. Unfortunately, scandals such as the unauthorized retention of human tissue and organs of deceased infants at the Alder Hey Hospital and the Bristol Royal Infirmary for research purposes have generated a lot of negative media coverage. (6) This subsequently

created many misconceptions and great distrust within the public towards post mortems. Even subsequent inquiries and legislation aimed at addressing these concerns have failed to improve the public's image of the post mortem. (6, 7)

A lack of available information also contributes to the public's misunderstanding of autopsies. Consent was often declined due to the impression of a possible delay in funeral arrangements or a lack of understanding about the processes involved. (8) Relatives often fail to appreciate the benefits an autopsy may provide, and would rather preserve the dignity of the deceased over finding the exact cause of death. (9) Other common reasons include moral or religious objections or fears of inappropriate body handling. (10)

## THE DOCTOR

The reasons for the decline in autopsies are not solely attributable to the public. Doctors are also responsible as the number of post mortem requests by clinicians has shown a general decline. Clinicians only requested autopsies in 6.2% of cases, despite consent being given in 43.4% of cases. (6) There have been a range of plausible reasons to explain the low rates of post mortem requests. Many clinicians have deemed the autopsy outdated, as advancements made in modern investigative technologies have prompted higher levels of confidence in ante-mortem diagnoses amongst clinicians. (11) Radiological imaging methods provide high quality images and the ability to obtain tissue samples via biopsies. This has greatly improved the accuracy of ante-mortem diagnoses,

especially in cases of malignancy. (9) The increasingly confident clinician, coupled together with a diminishing interest and perceived clinical value in the autopsy amongst clinicians, has contributed to the low request rates. (12, 13)

Many doctors also report a lack of training and confidence in obtaining consent for post mortems. The Broderick report (14) and a joint report between the Royal College of Physicians and the Royal College of Pathologists (15) recommend that death certification should be performed by a senior member of the team. However, it is the junior doctors who often end up obtaining consent in reality. (6, 16) Junior doctors often feel that they have not received sufficient guidance or encouragement to do so from senior colleagues and are unsure whether families would appreciate being asked about post mortems. (10) Many junior doctors have never seen a previous autopsy, and feel inadequately equipped with information about autopsy procedures or available alternatives to address the patient's concerns. (10) Although slightly more contentious, the potential of post mortem findings being used in malpractice litigation has been thought to be a possible contributory factor. (17) Other factors include a lack of positive stimuli such as the absence of a required minimal percentage of post mortems amongst hospital deaths required to maintain residency training programs, or simply due to limited resources. (17)

A lack of co-operation between clinicians and pathologists has also been thought to be a contributory factor towards the decline of post mortems. The post mortem report is often unavailable within 'clinically-relevant time', and there is often a lack of direct

communication between pathologist and clinician during the time of autopsy. (9) This has resulted in many clinicians undermining the importance of the autopsy.

## THE USES OF THE AUTOPSY

### FURTHERING MEDICAL KNOWLEDGE

There are many uses of the autopsy in the practice of modern medicine. Autopsies are used to describe characteristics of new diseases. Eminent physicians such as Virchow and Osler previously used the autopsy in the nineteenth century to understand the pathology of fatal diseases such as endocarditis and pulmonary embolisms by correlating pre and post mortem findings. (18) Autopsy findings have since provided the foundation for much of modern medical knowledge. (17) Since 1950, it is thought that over 80 major and possibly thousands of minor conditions have been discovered through the use of the autopsy. (19)

Today, autopsies continue to be of use in the description of emerging diseases such as the acquired immunodeficiency syndrome and variant Creutzfeldt-Jakob disease. (20, 21) The advancements made in medicine have also led to a new spectrum of iatrogenic diseases which require further understanding. Aluminium encephalopathy as a result of chronic dialysis and various fungal superinfections have also been studied extensively through the use of autopsies. (22, 23) Furthermore, the autopsy and brain banks are the principle sources of brain and heart tissue material as these organs are less

frequently sampled in the living. This enables poorly understood neurodegenerative disorders such as Alzheimer's disease and Parkinson's disease to be studied extensively. (24, 25) There has been, and will continue to be new conditions to characterize and understand. This is where the autopsy will always have a role to play.

The information gained from autopsies often acts as a catalyst for the advancement of medical therapeutics. The autopsy is additionally then able to measure the efficacy of this implemented treatment retrospectively. In Australia, mandatory thiamine supplementation in bread supplies was enforced and the prevalence of Wernicke's encephalopathy declined drastically subsequently. The effects of thiamine supplementation were verified through autopsies. A more modern example would be the validation of the therapeutic efficacy of gene therapy with autopsies. (26) Vaccinations for Alzheimer's disease were recently introduced, and the efficacy of this novel treatment will need to be studied with subsequent post mortems. (27)

## CLINICAL AUDIT

The autopsy can also be used for quality assessment. The autopsy acts as the 'gold standard' for which the accuracies of current diagnostic techniques are compared against to derive test specificities and sensitivities. (20) The use of echocardiograms to diagnose pericardial diseases, or electrocardiographs in the diagnosis of acute myocardial infarction, was only implemented after their accuracies were validated against autopsies. (28, 29) This is important because discrepancies will continue to exist despite the

advancements made in diagnostic imaging and testing. For example, autopsy has shown that current available methods in diagnosing fungal infections are still unable to differentiate between colonization effects or systemic infections. (30) Computed tomography scans can also fail to detect distal pulmonary emboli, and transoesophageal echocardiograms are unable to detect vegetations on occasion. (30)

In addition, the autopsy is also able to serve as a quality reassurance tool to assess the standard of clinical practice. (17) Discrepancies between clinical diagnoses and post mortem findings can be divided into two categories. Class I errors are treatable, where a correct pre-mortem diagnosis would have altered therapy and survival. Class II errors are untreatable, and even an accurate pre-mortem diagnosis would have made minimal difference. Studies have shown that class I errors range from 7% to 13%, and class II errors range from 9% to 31%. (31) The autopsy can identify the patients whose deaths could have been prevented. Approximately 35,000 of the 850,000 deaths annually in the US could have been prevented had an accurate pre-mortem diagnosis been made. (32) The autopsy will have an even greater role to play in monitoring the quality of care in the increasingly ageing and obese population with multiple comorbidities. (33)

The findings of the autopsy also have many implications beyond that of the clinical setting. In research, missed diagnoses detected at autopsy may significantly affect outcomes studied in clinical trials. (33) 30% of death certificates in the UK are estimated to have inaccurate causes of death. (34) These inaccuracies can have implications on policy-making both at a hospital level and at a national level. Funding and resource

allocation, major public health policies are all dependant on such vital statistics and estimates of the disease burden, which are accurately provided for by the autopsy. (33)

### BENEFIT TO FAMILY

The benefits of the autopsy also extend beyond direct patient care. A clearer understanding behind the cause of death can help in the grieving process. (35) 88% of family members reported that knowing the cause of death, or having the reassurance that the clinical care provided was appropriate, was greatly beneficial. (10, 36) In rarer instances, there may be more objective benefits through the discovery of genetic diseases such as haemachromatosis or medium-chain acyl-CoA dehydrogenase deficiency. (37, 38) This enables the family to be counselled on the implications and subsequent management of having a genetic disease. (39)

### TEACHING

Lastly, the autopsy can be used as a teaching tool. Medical students reported that the autopsy offers a better opportunity to learn anatomy, gross pathology and sharpen observational skills. (40) Students were also able to learn soft skills such as professionalism and attitudes of respect. This desensitization process when observing autopsies is thought to help prepare students for the future when they will have to care for dying patients. (41)

## THE CHALLENGE OF MODERN TECHNOLOGY

It is now apparent that the autopsy still has much to contribute to modern medicine. The notion that the autopsy is dead and has nothing to offer can therefore be refuted. The other opinion that the autopsy is obsolete, inflexible and should be replaced by modern diagnostic techniques is similarly untrue.

The autopsy is adaptable. There is the option for minimally invasive autopsies in appropriate situations. Needle autopsies can be performed when relatives are unwilling to consent for a fully autopsy, or when there is a serious threat of infection. (42) These autopsies extract tissue samples for examination with high accuracy rates. (43) Endoscopic autopsies offer a less invasive but still accurate alternative for patients who have suffered fatal traumatic injuries. The availability of these minimally invasive autopsies has been shown to result in a higher rate of autopsies. (44)

The autopsy is not obsolete. This opinion is supported by the fact that no differences in diagnostic errors rates were observed in the 1960s, 1970s and 1980s despite the availability of new diagnostic modalities. (22) Doctors were also unable to predict patients with major unexpected post mortem findings despite extensive clinical investigations. (45) Computed tomography (CT), magnetic resonance imaging (MRI) and molecular biology are all still incapable of reducing diagnosis errors to an extent of rendering the autopsy irrelevant. CT scans have reported significantly high rates of false positives, and cannot detect contusions or superficial lesions such as small haematomas

or lacerations. (46, 47) Similarly, MRI is limited by image resolution and can only offer less precise diagnoses. For example, an autopsy would be able to provide a diagnosis of acute myocardial infarction secondary to coronary artery thrombosis where an MRI would only be able to determine ischaemic heart disease. (40) Imaging alone is also unable to sample the body for toxins or micro-organisms, or to provide tissue samples for histopathological studying or microbiological testing. (48) In addition, an MRI autopsy can cost five times more than a standard autopsy, and creates extra strain on equipment already high in demand. (49) Studies have largely been equivocal over the benefits of MRI autopsies over standard autopsies. (50)

It must not be misunderstood that these modalities have no place within the autopsy. Indeed, the standard autopsy offers what any imaging modality is yet to be capable of. The pathologist is able to maximize the use of his sensory modalities during the autopsy. He is able to see colours and palpate to appreciate differences in texture. For example, a pathologist may be able to detect sub-periosteal bleeding around a hairline rib fracture which the radiologist is unable to due to limitations in image orientation. (51) However, standard autopsies are not without limitations. Despite careful palpation and dissection layer by layer, there have been occasions when bullets clearly visible on x-rays were surprisingly difficult to find during autopsy. CT scans are also better at detecting gas embolisms and small pneumothoraces than standard autopsies. (46, 51) Moreover, MRI and other non-invasive post mortem tests may serve as an adequate replacement when consent to a full autopsy is not given. (51)

Pre-autopsy MRI findings can also be added to autopsy findings to make it more robust. 81% of cases yielded a more precise diagnosis when pre-autopsy MRI was used together with autopsy, as compared to autopsy alone. (52) Imaging has been used to great success as adjuvant techniques in forensic autopsy practice, giving rise to the concept of virtopsy. (53) Virtopsy consists of documenting and reconstructing the body in a virtual three dimensional view through scans, allowing for virtual autopsies to be conducted freely. (54) This is current practice at the Forensic Pathology Department in Leicester, UK. (55) It therefore follows that both dissection and imaging are complementary techniques, and maximal results can be obtained should the two be integrated together.

The autopsy has incorporated the advancements made across the centuries for its benefit. These advances include histology, biochemical testing, radiographs and now CT, MRI, angiography, and even the use of DNA and genetic testing. Perinatal autopsies routinely use cytogenic karyotyping and DNA PCR testing to aid their findings. (56) Research is ongoing to refine the current autopsy and improving diagnostic accuracy. These include immunohistochemical detection of markers of inflammatory cellular response such as VLA-4 and ICAM-1 in possible pulmonary sepsis where routine autopsies were inconclusive. (57) In forensic autopsies, molecular detection of troponin and thyroglobulin has been thought to accurately estimate the time of death. (58) It is therefore apparent that the autopsy should not be viewed as non-progressive or obsolete.

REVIVAL

Although the autopsy is not dead, the autopsy does currently need help in raising its profile within the public and the profession. The consultant who has no interest in the autopsy trains junior doctors who are similarly disinterested. (11) Even 80% of clinicians who felt that autopsies were useful had actually never attended a prior autopsy. (11) Unfortunately, these clinicians were largely equivocal towards changing their practices to improve the uptake of autopsies. (11)

Measures must be taken to improve the situation the autopsy currently finds itself in. Low uptake rates diminish the potential benefits of the autopsy. (11) Several strategies in a hospital increased autopsy rates from 16% to 36% within a year. (59) These included prompt and effective communication of autopsy findings to clinicians and family members, provision of training in obtaining consent, and a cohesive integration of all autopsy related services. (60) Non-medical patient affairs officers may also be trained to obtain consent. (11) In Japan, all medical schools are required by the government to conduct a minimum number of autopsies. (11) Small groups of hospitals could be specially funded to carry out more autopsies, with their findings possibly large enough to be representative of the general population. (32) The autopsy should be integrated into the medical school curriculum, as doctors with no previous autopsy-based teaching are less likely to request for autopsies. (4) These measures would lead to a rise in the rates of autopsy and contribute further to the survival of the autopsy.

The autopsy is currently not dead, but it is undoubtedly in a state of decline. The autopsy cannot be dismissed as useless, as it has many important contributions to offer to

medicine. The autopsy is not obsolete, because various advancements made in diagnostic techniques have been continuously incorporated into the autopsy. The challenge is therefore for the autopsy not to prevent itself from being replaced by modern diagnostic techniques, but rather how to successfully incorporate these techniques into routine practice to better improve its findings. It is only through constant refinement and adaptation through the years that the autopsy can be guaranteed of its survival. Just as how the question regarding the possibility of the autopsy being dead was dismissed both 45 years ago and today, efforts must be taken to ensure that the autopsy evolves continuously to allow subsequent generations to benefit from the autopsy.

(2997 words)

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