

By David Hurlbut – presented at Dept. of Medicine Morbidity and Mortality Rounds

Resuscitating the Autopsy: Why our current 7% rate of non-forensic autopsies is unacceptable (and a suggestion for a remedy)

Autopsy: *a postmortem examination. From Greek, *autoptēs* ‘eyewitness’ (autos ‘self’ + optos ‘seen’).*

Medicine has a longstanding practice of conducting Morbidity and Mortality (M&M) rounds. These rounds serve to improve quality of care and reflect a recognition of our professional fallibility and of the need to constantly monitor and improve Medical practice. M&Ms are a weekly rounds, open to the institutions’ health care professionals, in which cases are presented. Some cases have a poor or unexpected outcome, some are “near misses” and others are diagnostic mysteries. In recent years, we often discuss disease management strategies or the results of new surgical or medical procedures. The spirit of M&M rounds is one of constructive, non-defensive, collegial discussion (i.e. it is not a place for blame). This safe environment allows remarkable candor and helps us improve the quality of individual practice and the function of our health care system. Our M&M Rounds is directed by Dr. David Lee, Chair of Hematology. We began the 2015-16 series of weekly M&Ms with a review of the autopsy by [Dr. David Hurlbut](#), from the Department of Pathology and Molecular Medicine.



Dr. Hurlbut (top); Dr. Lee (bottom)

This blog highlights the importance of the autopsy, a key

component of M&M Rounds that is rapidly disappearing. The autopsy has traditionally served as the gold standard establishing the accuracy of premortem diagnosis and for establishing the cause of death.

Postmortem dissections began ~300 BCE in Alexandria but it was Galen, the Greek physician, in the late 2nd century CE who used postmortem observations to explain the patient's signs and symptoms in life – the clinic-pathologic correlation. It was the renaissance physician, Andreas Vesalius who arguably brought the modern autopsy into medical use in the mid 1500s CE. The autopsy tells us when we were right, when we were wrong, and has long provided students of Medicine with anatomical information and offered researchers precious tissues. The autopsy has provided clarity and comfort to the family and friends of the deceased and, of course, the forensic autopsy has been critical to establish the cause of death in criminal cases. Although the autopsy has served Medicine and patients well we are squeamish with topics relating to death and autopsy is rarely in the limelight. It is often either ignored or talked about only privately and the quality and quantity of autopsies performed is rarely a metric a hospital brags about. Like most things that are ignored or undervalued, the autopsy has been in decline.



Dr. Hurlbut addressed questions regarding the autopsy that are of interest to practitioners and the public at large: *Why do we do autopsies? How often do we do autopsies? Will an autopsy interfere with normal funeral/burial practices? Does an autopsy result in an expense for the family?* Let's take these questions in order.

Why do we do autopsies?

1 To determine the cause of death: This is very important both for education of the physicians (were we correct in our diagnosis?) and for the family (did the doctors treat the correct condition?). Families and physicians also use autopsy results to learn whether there were errors of omission or commission in the care—even if they might have been unavoidable. By establishing the medical cause of death the autopsy often provides clarity and reassurance for the grieving family. The autopsy by determining the cause of death may also be crucial to allow dispersal of the deceased's estate or to claim life insurance benefits etc. Increasingly, autopsies yield tissues and molecular information that may identify familial diseases, which is of great interest to the surviving family members.

2 To establish a pathologic correlation: In 2015, armed

with endoscopy, heart catheterization, MRIs, CT and PET scans and laboratory tests surely we must know why most patient die? Many physicians are confident the answer to this question is YES. However, this confidence is not well justified. Even in the modern era, autopsies provide an invaluable insight into the cause of death and the nature of disease. Autopsies continue to provide a foundation for quality control and inform the practice of Medicine. At even the best hospitals, diagnoses will be made in error or a diagnosis will not be made in life. These errors of commission or omission can be addressed by the autopsy. In a 1998 study of 1105 autopsies, a substantial number of malignancies were found for the first time at autopsy ([JAMA 1998 280: 1245](#)-SEE TABLE 1). In fact, 44% of all cancers noted in this autopsy series were only discovered by the pathologist (even though the cancers were often advanced, i.e. 54% had metastasized).

Table 1.—Number of Undiagnosed or Misdiagnosed Malignant Tumors Found at Autopsy, by Site

Tumor Site	No. (%)
Respiratory tract	37 (33)
Gastrointestinal tract	25 (23)
Genitourinary tract	18 (16)
Hepatobiliary tract	12 (11)
Central nervous system	5 (5)
Heme/lymph	4 (4)
Unknown	4 (4)
Endocrine	3 (3)
Musculoskeletal	2 (2)
Breast	1 (1)
Total	111 (100)

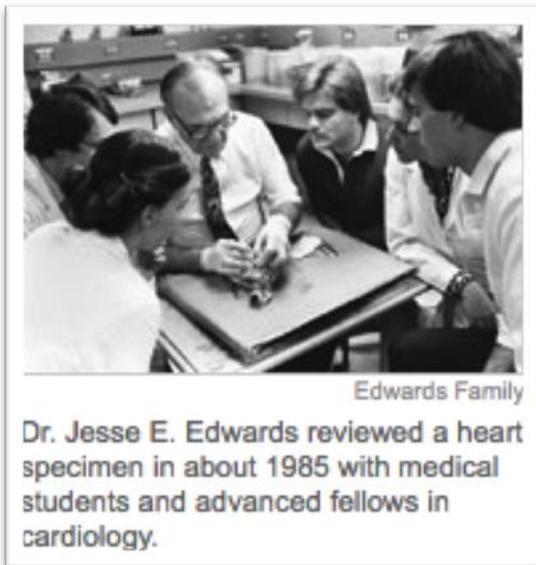
The autopsy allows diligent clinicians to improve their diagnostic algorithms and refine therapeutic strategies. The autopsy may help the family by explaining an otherwise sudden or unexplained death. Other times the family takes solace from the belief that their loved one's autopsy has contributed to medical education or research and thus constitutes a societal gain.

In a paper entitled ***Autopsy as a quality control measure for radiology, and vice versa***, Murken ([Am J Roentgenol. 2012 Aug;199\(2\):394-401](#)) assessed the diagnostic accuracy of radiologists at a University hospital against the gold-standard of autopsy. A substantial number of errors/misses were detected (i.e. in 201/729 cases the radiologic diagnosis was incorrect). The authors concluded that radiologists could sharpen their skills by correlating their antemortem findings with autopsy findings. Since we are always training new physicians, an ongoing autopsy program should be part of a robust quality improvement system within all teaching hospitals. The benefit of such clinical-pathologic correlations is not unidirectional. The pathologists also erred from time to time and, in 32 cases, the radiologist's diagnosis was deemed correct. This bidirectional benefit of clinical-autopsy correlation conferences (M&Ms) applies to all disciplines- surgeons, medical specialists, and internists.

3 Medical education Trainees, the next generation of health care professionals, benefit enormously from a vibrant autopsy program. As a faculty member at the University of Minnesota, I worked with [Dr. Jesse Edwards](#) at the Minneapolis Veteran's Affairs Medical Centre. Jesse was one of the world's leading pathologists and a former president of the American Heart Association. He was known to all for his 600+ articles and the Heath-Edwards scoring system for assessing the severity of pulmonary vascular disease in children with pulmonary hypertension due to congenital heart disease, etc. He was known to me for his ability to "read" the heart of an autopsied patient and recreate the patient's life (as well as their disease). At the time, I ran the cardiac ultrasound program and Jesse and I ran a conference for the fellows in training. I showed an ultrasound; Dr. Edwards examined the autopsied heart. I always kept Jesse blinded to the patient's diagnosis. He did this

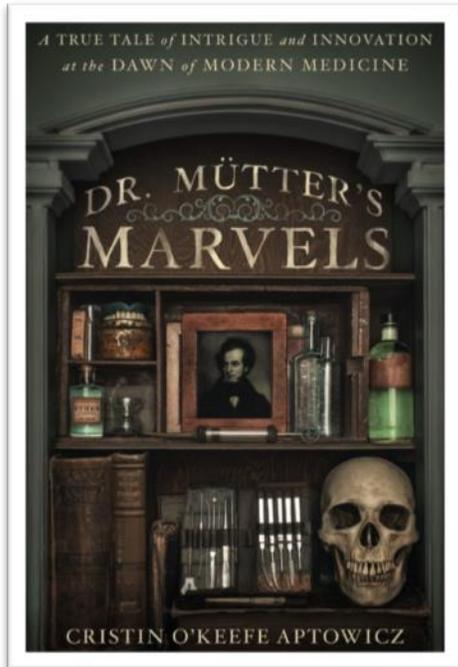
heart reading by means of keen observation and gentle palpation while offering a “stream of consciousness” account of the patient’s likely clinical story.....estimating the person’s age, gender and disease. Dr. Edwards had uncanny accuracy! As a result of Dr. Edward’s clinical-pathologic acumen, my echocardiographic interpretive skills were put under the microscope. I learned and my clinical accuracy improved. This took time, vision, and some resources.....and required that autopsies were obtained on a regular basis.

Jesse loved anatomy and pathology. He became a collector of interesting cardiac specimens. *“Every time I saw a heart,” he said, “it seemed so wasteful to let it go.”*

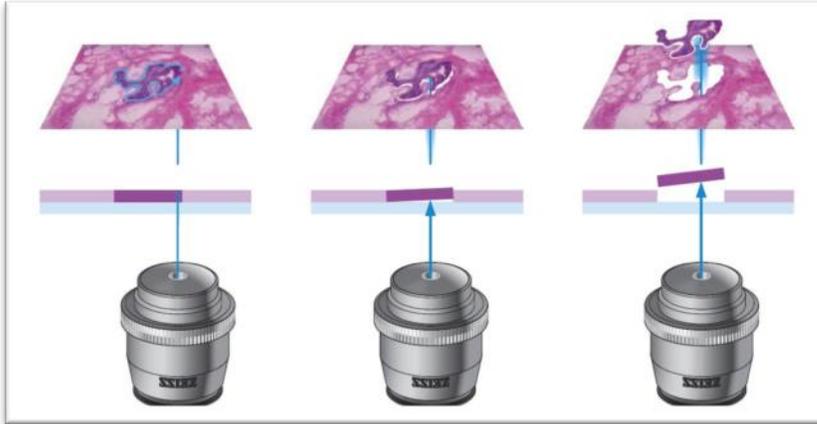


Over his lengthy career (and into his “retirement”), Dr. Edwards amassed a teaching collection of 22,000 specimens of hearts, heart valves, lungs and blood vessels! From these he taught 3 generations of surgeons, pathologists and cardiologists. Dr. Edwards was a 20th century version of Dr. Mutter, a pioneering surgeon who worked in Philadelphia in the early 1800s. Dr. Mutter understood the value of the clinical-pathologic correlation as an approach to panning his remarkable and daring surgeries. Dr. Mutter needed to understand anatomy-he was

performing plastic surgery in the era before anesthesia—speed and accuracy mattered! If this sounds interesting I highly recommend, [*Dr. Mutter's Marvels: A True Tale of Intrigue and Innovation at the Dawn of Modern Medicine*](#) by Cristin O'Keefe Aptowicz.



4 Medical research: Autopsies are performed with the written consent of the deceased's family. The consent authorizes the use of tissues for research. The autopsy is thus a rich source of cellular and genetic information, particularly if done rapidly after death. We can now harvest tiny numbers of cells for culture or study their genomic or proteomic profile postmortem. This molecular autopsy uses new techniques, such as laser capture microdissection (LCM). LCM measures protein and gene expression in patients with well-defined diseases (as determined by their autopsy). Using an LCM system, like the Zeiss Palm ®, we can isolate a suspicious clump of cells and catapult it into a tiny container for PCR gene analysis (as shown in diagram).



This image illustrates the PALM MicroBeam from Carl Zeiss provides a tool in molecular analysis at DNA, RNA and protein levels, as it highly improves sampling of cell-specific tissue. In addition, it is possible to sample individual living cells or small groups of cells to be used for direct molecular analysis or re-cultivation. The specimen is [microdissected by a focused laser beam](#). Then a defined laser pulse transports the cut piece of the specimen out of the object plane into a collection device.

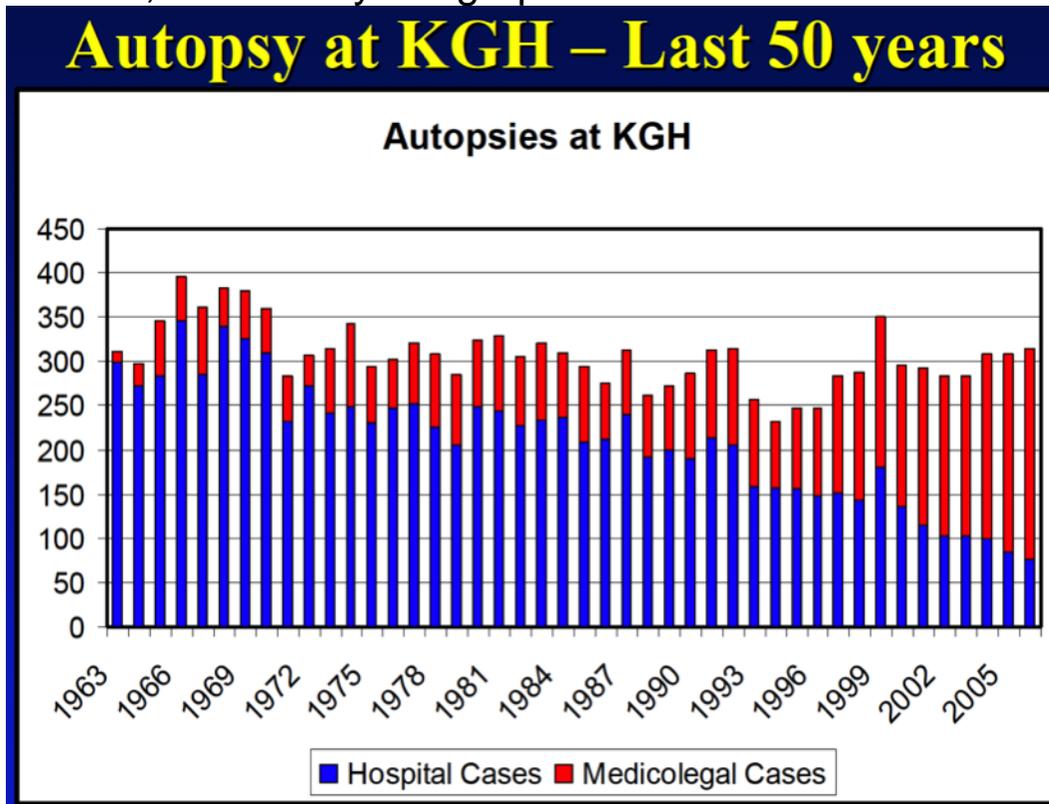
The new Molecular autopsy helps clinicians develop [a deep phenotype](#) for diseases that is a necessary step on the road to improved diagnosis, therapy and a cure.

5 Medical statistics, epidemiologic and public health issues: The identification of HIV, SARS and other emerging disease relied on autopsies and material acquired at autopsy. A vigilant autopsy program accelerates our discovery of new diseases. The autopsy is part of the post-marketing surveillance system for new medical devices. It offers a stark and unbiased view how devices and biomaterials function in patients.

6 Medicolegal investigation of death: Courtesy of Quincy and CSI Miami, the forensic autopsy (unlike the nonforensic autopsy) is in the public consciousness. In sudden or unexplained deaths or for patients in custody, a forensic autopsy, performed at the request of

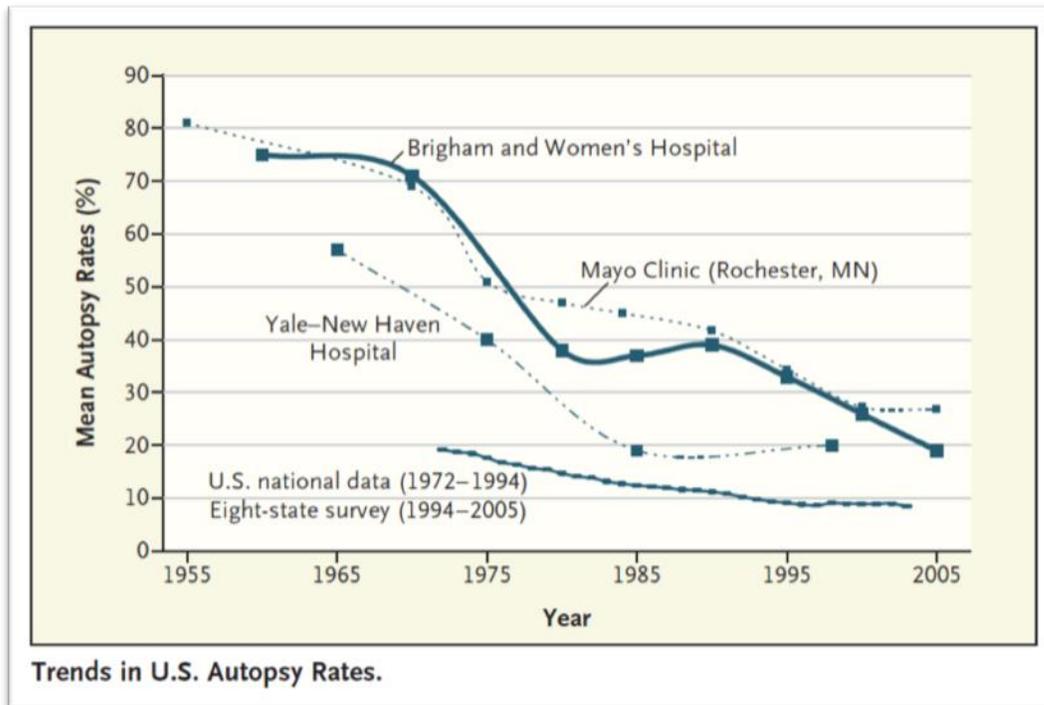
the coroner, is crucial.

How many autopsies are we doing: In brief, not enough! Approximately 7% of in-hospital deaths at KGH are subject to autopsy. Interestingly, the forensic autopsy (in red-below) accounts for a rising percentage of the total autopsies performed at KGH. The non-forensic autopsy (i.e. autopsy not requested by the coroner) has been in continual decline at KGH, as seen by the graphic below.



KGH=Kingston General Hospital, the tertiary care teaching hospital at Queen's University

The death of the autopsy is not a local problem-it is international, as evidenced by the data from the USA, published in 2008 in the NEJM by [Shojania KG](#) and [Burton EC](#).



From: *N Engl J Med.* 2008 Feb 28;358(9):873-5. doi: 10.1056/NEJMp0707996.

The cause of the decline in autopsy rates is multifactorial. It takes time to have the conversation with the family, obtain consent for an autopsy and dispel misapprehension that an autopsy might delay the funeral (it does not) or that it results in a bill for the service (it won't). Some physicians may fear it opens them to litigation by revealing a diagnosis that was missed in life. This is theoretically possible, but, in my experience, is rare. Some feel the feedback from Pathology comes too late. Per Dr. Hurlbut, our Pathologists provide a preliminary report to the attending physician (with copy to the family physician) within 1 day and a final report should follow within 12 weeks (3 months).

How do we resuscitate the autopsy? The answer is a composite:

- 1 A) Pro-autopsy, role-modeling by attending physicians.
- 2B) A proactive autopsy quality assurance program (by Pathology) that ensures the service is accessible,

timely and meets family and physician expectations.

1 A) Role modeling: If we, as attending physicians, make it clear to trainees that an autopsy is expected it will happen more frequently. Ideally, each in-patient death should provoke the question-should we do an autopsy? If we set the expectation that, in the event of an inpatient death, the default position is to approach the family for permission to autopsy, autopsy rates will rise. What is the evidence for this statement?

A study in England (Harris, A. et al J R Coll Physicians Lond. 1993 Apr;27(2):116-8.) looked at the role of [physician attitudes toward autopsy](#) on autopsy rates at a teaching hospital over a 4-year period. The average rate of autopsy on patients who died in hospital was 16.5%; however, there was tremendous inter-physician variation in the rate of autopsy (ranging from 5-35% of deaths resulting in an autopsies). Rates of autopsy also varied by specialty: general medicine (14%) vs. cardiology (21%) vs. geriatrics (23%) vs. paediatrics (36%) vs. general surgery (13%). In this study, physicians underestimated the value of autopsy while over-estimating their actual autopsy rates on their service. High rates of autopsy (defined as a range of 18-30%) occurred when the senior physician established “*a definite policy regarding autopsies and had made this clear to their junior staff*”. Low rates (6-10%) occurred when there was no faculty policy on autopsies. I agree with the authors’ conclusions, “*Physicians should be more aware of the value of autopsies, and should take responsibility for increasing and monitoring autopsy requests to improve clinical audit, quality assurance and medical education.*” My request to colleagues in the Department of Medicine is that they discuss indications for autopsy with trainees and make it a priority to obtain autopsies on a substantial proportion of patients that die in hospital. In my view a death in hospital should raise the question of autopsy and the default position

should be to discuss this with the patients' family. To make this a reality, the house staff and faculty physicians need to be armed with information about the reality of autopsies (i.e. no patient fee and no delay in funerals) and have support to facilitate obtaining informed consent (i.e. autopsy cards-see below). Moreover, the physicians must be convinced that the autopsy reports will be timely and valuable, and that the autopsy plays a critical role in quality assurance, medical research, and medical education.

1 B) A proactive autopsy service: There is evidence that when pathologists are proactive about promoting autopsies rates of autopsy improve. For example, when the following improvements were made at one academic pathology site, rates of autopsy stopped declining and began to increase.

Quality Improvement on an Academic Autopsy Service

John H. Sinar, MD, PhD; Deborah J. Blood, PhD

● **Context.**—Autopsy rates continue to decline in the United States.

Objective.—Although many of the causes of this decline are external to pathology departments, we hypothesized that intradepartmental efforts to improve the quality of the service we provide to our clinical colleagues could increase our autopsy rate.

Method.—We developed a multifaceted quality improvement program for our autopsy service aimed at increasing the visibility of the service, improving the service's reporting, and increasing the amount and quality of data available from the service.

Setting.—A large academic medical center that performs approximately 250 autopsies each year.

Results.—After implementation of our quality improvement program, the decline in our autopsy rate has not only stopped, but rates have even begun to increase. Additionally, physician satisfaction surveys conducted before and after implementation of our quality improvement initiatives showed an across-the-board improvement in clinician perception of the service.

Conclusion.—Pathologists can and should be proactive in addressing the declining autopsy rate, rather than viewing it as someone else's problem or hoping that someone else will protect this important quality assurance tool for medical care.

(Arch Pathol Lab Med. 2001;125:237-245)

Table 1. Autopsy Service Quality Improvement Initiatives
Increase the visibility of the service
Conferences
Morbidity and mortality
Orientation
Death certification
Autopsy card
The Decedent Affairs Program
Administrative packets
New module for clinical support system
Family informational pamphlet
Improve the service's reporting
Better communication with clinicians
Phone calls to clinicians
New autopsy permit
More complete provisional reports
Rush histology service
Cause-of-death statements
Better turnaround times to final report
Establishing mechanics
Packaging case at time of provisional anatomic diagnosis
Changing attitudes
Increase the amount and quality of data
Autopsy rate and request rate data
Clarification/discrepancy data
Quarterly reports

Notable in the intervention was creation of an autopsy card that explained the value of the autopsy, dispelled myths and assisted house staff in obtaining informed consent.

Solutions?

- Each attending should establish the expectation with trainees that an autopsy be considered for patients that die in hospital.
- The hospital leadership should establish a target autopsy rate as a Quality metric. I do not know the right number but perhaps a 15-20% rate for non-forensic autopsies should be our aspirational goal.
- The Autopsy service should work with the clinical services and patients to provide a concise, patient friendly autopsy card that makes it clear how the important autopsy is while dispelling myths about autopsy that are impediments to obtaining consent

The attendance at M&M and autopsy rounds should be reinforced by Department Heads as being a key part of our education and maintenance of competency programs.

The autopsy is an endangered species. The medical profession and patients will be ill served if we loose this

important resource. I look forward to hearing your views on this subject