Cadeveric Anatomical Education in the 21st Century: Preserving Medical Education

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Abstract

Anatomical medical education through cadaveric dissection is a tradition that has been preserved through the centuries. Advancements in medical knowledge were gained throughout millennia through dissections of animals and humans. Now, the roots of this heritage wither as medical programs restrict laboratory time in favor of more modern educational techniques. We seek to promulgate a medical student's perspective on the use of cadaveric dissection within the curriculum and why dissections must remain an imperative part of medical education. Continuing a hands–on approach to anatomical systems will ensure both educational and medical standards are achieved and enhanced.

Education in human anatomy through cadaveric dissection is a pedagogical tool nearly as old as the profession of medicine itself. Ancient literature by Galen and Hippocrates was dominated by dissections and vivisections of animals, whereby the foundation of medicine flourished.[1] Modern medical training arguably began during the Renaissance (14th-17th century), with key anatomists and physicians such as Andreas Vesalius and William Harvey producing seminal works on anatomy and circulation, respectively.[2,3] These advances in the wealth of knowledge were hard won, continually facing pressure from hierarchical institutions. Despite the medical profession's pedigree in anatomy, there has been a reduction in the volume of information instructed via cadavers over the past decade, as various stakeholders vie for valuable time and resources.[4,5] Here, we provide a student's perspective in this debate, asserting that cadaveric dissections have irreplaceable educational benefits in medical education. To emphasize this point, we will begin by discussing the change in pedagogical tools by examining the progression to prosections and digitization in anatomy. We will then discuss the importance of cadaveric dissection in the comprehension of organ systems and its benefits to practitioners.

Medical education is evolving with the development of new diagnostic and imaging technology. The incorporation of digital imaging and 3D rendering software, which allow learners to peer deeply into body systems, gives modern students a significant advantage over the forebears of anatomy, who dissected to understand structure and vivisected to understand function.[6] Despite these advances, studies have failed to prove superiority of digital education over dissection.[7,8] In fact, Saltarelli et al. suggest that cadaveric dissections may better facilitate knowledge transfer from laboratory to clinical practice.[9] We propose that the digitization of anatomy as an instructing medium alone does not allow the student to critically appraise the body in its totality and thus cannot completely replace the cadaver. These tools do indeed come close to cadaveric anatomy, with the ability to manipulate, remove, and rotate structures digitally; however, this approach and that of 3D renderings lack the inherent advantage of tactile learning. We believe that the ability of the learner to observe structures—feel by hand their tensile properties, thicknesses, and diameters—and physically follow the neural and vascular input is of paramount importance. This form of kinesthetic learning is favored by medical students and has been reported to enhance deep comprehension, thus improving the students' ability to apply information to other fields of medicine such as radiology.[10,11] Furthermore, these kindly donated cadavers provide the opportunity to practice clinical techniques that would not be possible with digital constructs.[12]

To understand how disease impacts patients, one must comprehend how the various organ systems interact. While cadaveric anatomy in the 21st century is not always implemented, many institutes that hold true to this tradition deliver laboratory sessions by anatomical region.[13] However, Brooks et al. report reductions in student comprehension and performance when anatomy is taught focusing on specific regions (e.g., using prosections) as opposed to systems.[13] Additionally, among programs that instruct using prosections, there is evidence that brief exposure to whole–body dissections is viewed favorably in enhancing clinical skills and overall anatomical comprehension.[14] These findings illustrate an inherent disadvantage of prosections in anatomical education, whereby students are required to piece together individual regions instead of understanding the body as a whole. For example, students may not fully understand the mechanism of Pancoast's syndrome if they only view the lungs in isolation, neglecting the neurovascular structures located superomedially. As such, we assert that a systems–based approach may best suit the clinician–in–training.

In a recent survey of physicians from diverse specialties, 50.9% of respondents indicated gross anatomy knowledge was most fundamental to clinical practice, followed by physiology (38.6%) and pharmacology (32.1%).[15] Anatomy is utilized by the majority of clinicians as they interact with patients through landmarking and surveying for disease.[16] Proper identification of structures is essential for ensuring adequate sensitivity and specificity in physical examinations, which students are required to perform with competency and precision. With in–office procedures such as injections and excisions being common practice, anatomy does not remain solely within the domain of the surgeon. For example, in 2006, 36% of Canadians reported experiencing some form of musculoskeletal disorder, making it one of the most common reasons for a physician office visit.[17] These visits necessitate special physical exams, landmarking, and possible application of intra–articular medications in order to diagnose and treat the patient. Finally, cadaveric dissection provides students with the opportunity to sequentially view structures from superficial to deep, allowing for better comprehension of layers and their respective landmarks. As future practitioners, we view this deep understanding of anatomy as an integral part of our ability to deliver timely and quality care to patients.

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A seemingly inevitable trend in science is the favoring of a reductionist approach, focusing inwardly to the protein, genome, and gene level.[18] This gaze has undoubtedly led to significant advances in medical screening, diagnosis, and treatment; however, the ideology associated with this "one–gene disease" phenomenon fails to fully address systemic complications. Facilitated by the continual introduction of newer methods and technology, anatomical education too has fallen victim to this reductionist approach, focusing on specific body regions rather than a whole–body approach. We suggest that the concept of "systems biology" should be extended to medical education in anatomy, whereby cadavers are used to provide students with hands–on experience in learning about the human body as a whole.[19] This approach, tactile in nature, will continue to facilitate greater comprehension and recognition of the impact of disease on the patient. The importance of these skills in evaluating the human body in its entirety has been reinforced time and time again and builds the foundation for clinical practice. The continuation of traditional cadaveric anatomy teaching, supplemented by the march of progress in technology, will ensure quality medical education and therefore quality diagnosis and treatment of patients.

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