

Insufficient Teaching of Laboratory Medicine in US Medical Schools

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Michael Laposata, MD, PhD¹

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For most of us who attended medical school more than 10 years ago, there was a course called “pathology” in the curriculum. The focus of the pathology course in most schools was almost exclusively anatomic pathology. The anatomic pathology of the myocardial infarction and the scar that evolves from it was shown to us with little information on troponin testing, despite the increasing difficulties in the interpretation of troponin test results. The change in the microscopic appearance of the myocardium showed the pathogenesis of myocardial infarction and, on that basis, was certainly important to discuss.

The laboratory medicine/clinical pathology that was taught was very “anatomic pathology like.” Clinical pathology that was largely associated with the microscope was commonly included, such as peripheral blood smears, Gram stains and stains for other microorganisms, and the antinuclear antibody test. There were also other tests described with visual rather than numerical results, such as the gels from serum protein electrophoresis, and the aggregation of blood cells in the determination of blood type and Rh status. However, this approach to medical student teaching of laboratory medicine completely omitted the teaching of tests that generated only numbers and no visual pattern. Major areas of the clinical laboratory test menu including coagulation, endocrinology, and toxicology, which have limited gross and microscopic descriptions, were minimally considered in the pathology course and in the pathology textbooks.

Over the past 10 to 15 years, a new approach to teaching basic science, including pathology, has appeared in many medical school curricula. The organ- or system-based approach includes pathology, but even in these basic science courses not called “pathology,” the pathology topics still remain dominantly anatomic. These are referred to as “student-centered curriculum,” in the form of problem-based learning and/or case-based learning. In these curricula, pathology/laboratory medicine learning objectives are woven into the first 2 years

of medical school, and learning objectives are developed from cases that have pathology and laboratory data. An increasing percentage of medical schools are all student centered, partly student centered, or currently going through curricular revision to become more student centered. Education of medical students in the United States by experts on the selection of clinical laboratory tests and interpretation of the test results remains at risk for being very limited in the student-centered curriculum as well.

Changes in the medical school curriculum have been occurring at a time when the test menu has been dramatically increasing in size, complexity, and cost. Highly complex genetic testing began to emerge in the clinical laboratory shortly after the year 2000, and medical students are poorly taught when to order such complex testing and how to interpret the genetic test results. Unfortunately, today medical students graduate and enjoy support by anatomic pathologists and radiologists to interpret test results, but they are faced with the impossible challenge of ordering the correct tests, and only the correct tests, from the thousands of expensive assays on the clinical laboratory test menu, with little or no education on the topic prior to graduation. In most institutions, no one is available to “automatically” help the treating physician with clinical laboratory tests as they are assisted in anatomic pathology and radiology, where cases are reviewed as a matter of course, without a special request. It is clear to me after 30 years in the field that less than 1% of the laboratory-related questions

¹ Department of Pathology, University of Texas Medical Branch, Galveston, TX 77555, USA

Corresponding Author:

Michael Laposata, MD, PhD, Department of Pathology, University of Texas Medical Branch, 301 University Blvd, Galveston, TX 77555, USA.
 Email: milaposa@utmb.edu



in the minds of treating clinicians are ever asked of us in the clinical laboratory, often resulting in silent but often severe diagnostic errors. Today, many of our clinical laboratories can perform whole-genome sequencing, and yet most clinicians using these laboratories have no idea how to evaluate the patient with a prolonged PTT or with a markedly positive anti-nuclear antibody test.

A group of academic pathologists, primary care physicians, and laboratorians from the Clinical Laboratory Integration into Health Care Collaborative (CLIHCC) work group from the Centers for Disease Control developed a survey of 15 questions with explanatory material. The survey focused on education provided by US medical schools on topics in laboratory medicine. Of the 131 schools from which data were received (78% of medical schools in the United States), 77% of the responses were provided by course directors and 23% from deans of education.

The article by Smith et al, which summarizes the results of this survey,¹ is an attempt to determine just “how bad it is” with regard to education of medical students on laboratory test selection and result interpretation. We learned several important things from this survey. In terms of lecture time, anatomic pathology ranges from 61 to 302 hours in the medical school curriculum, in contrast to clinical pathology/laboratory medicine lecture time, which is about 8 hours. Transfusion medicine education is about 2 to 3 hours of lecture. It is hard to imagine that the few hours of education in transfusion medicine during medical school permits our medical school graduates in the United States to transfuse blood and blood products, with no advice on most occasions, and avoid medical errors. The students are tested for their knowledge in anatomic pathology, as part of the examinations in their schools and in national examinations. However, there is little testing of the students regarding clinical laboratory test selection and result interpretation, and it is widely known that students direct their learning to the tests that they must pass to become practicing physicians. The report also revealed that there are many courses available in laboratory medicine/clinical pathology in medical institutions. Unfortunately, these appear to be elective courses listed in the course directory, which are taken by very few students. Medical institutions have the appearance of teaching clinical pathology, but the reality is that few students from medical schools today actually spend any time learning it—despite the fact that they need this knowledge every day of their clinical practice.

In September 2015, the Institute of Medicine, now known as the National Academy of Medicine, issued a report entitled “Improving Diagnosis in Healthcare.”² There were 8 major recommendations that emerged from this review of the

literature about the amount and severity of diagnostic errors in America. One of the principal recommendations made by the committee is that treating clinicians need to involve pathologists and clinical laboratory scientists as part of the diagnostic team because the knowledge required to make a quick and accurate diagnosis, for many of the cases in a medical practice, is more than the treating physician is likely to have. Pathologists trained largely in anatomic pathology are about to face many questions on clinical pathology topics that are not taught in medical school and not taught in most pathology residencies. There is a strong sense of urgency supported by data in the report by Smith et al that the pathology taught in medical schools must include information on the selection of laboratory tests and result interpretation; these courses must be taught by experts in the field; and this information must be included in medical school and national examinations, or the very serious problem of diagnostic error will continue to worsen. Pathology can become an indispensable part of the health-care team if the knowledge about what pathologists and clinical laboratory scientists can do is imparted to medical students and that it includes all of pathology, and not just anatomic pathology.

Academic departments of pathology bear responsibility, in teamwork with clinicians, to provide laboratory medicine teaching at the undergraduate medical level. What is needed? There must be an engaging, practically focused curriculum, with the laboratory medicine taught by experts in the field who understand the clinical use and the methods used to perform the tests. The students must be examined in some way on their mastery of the material. The content should involve the commonly encountered tests for most physicians and the confounding variables that affect these tests. The laboratory medicine course must challenge the students to select the correct tests, and only the correct tests, for specific clinical situations, ideally with an audience response system. Most importantly, the course must teach the students to know what they do not know and that when test selection or result interpretation uncertainty exists, they must learn to consult an expert and avoid making guesses that contribute to diagnostic error.

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