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Real Anatomy Lesson: Differential Diagnosis in the First Year Anatomy Course

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In designing the medical school curriculum something has to be taught first even though the basic sciences and clinical topics interlock. Students traditionally learn anatomy first and suspend ther bewilderment regarding the eventual application of the structural detail studied. Infinite memory chores are learned with little overall view of how the student's data bank will function in the acute clinical situation. A fundamental charge of physicians is to consider all diagnostic possibilities before implementing treatment. Yet with the current system, first year students find themselves in possession of large volumes of information but are still unable to establish even a rudimentary differential diagnosis. It is suggested that during the first year clinical anatomy course the student be introduced to broad categories of disease using anatomy as the structural foundation for visualizing diagnostic possibilities. Wasteful interludes in the laboratory could be replaced with memory-enhancing dissection using visual, verbal, auditory, and kinesthetic methods coupled with clinically oriented vocabulary expansion. A basic etiologic mnemonic is discussed as a framework for rapid diagnosis. In conjunction with the idea of decreasing medical information overload, we suggest that data presented to medical students in general be organized in a bicameral fashion as either emergent or elective. Anatomists and clinicians should consider rewriting the anatomy manual to include "clinical pathology."

Key words: bicameral data base, structural non-specifics

Traditionally, anatomy and physiolgy are presented before disease is encountered in the medical school curriculum, even though the basic sciences and clinical topics interlock. Students are expected to suspend their bewilderment regarding how the intricate structural detail learned is to be employed. Infinite memory chores are completed with little overview of the potential role the student's data bank will play in the heat of an acute clinical confrontation. The reason is that those involved in teaching first year anatomy rarely see patients. However, anatomists

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and clinicians share a common understanding of basic pathologic processes which may be taught in the laboratory setting.

Over 60 years ago Sir Zachery Cope (1921) wrote these words in a well-known monograph:

"Many examinations of the abdomen are imperfect because the practitioner does not act upon the important principle of applying his knowledge of anatomy."

It is only when anatomy is employed to answer diagnostic questions that it becomes truly clinical because the establishment of a diagnosis always precedes treatment. Currently, first year students find themselves engorged with large volumes of data, and yet they are unable to formulate even a rudimentary differential diagnosis. To make anatomy more useful it is suggested that elements of pathology be incorporated into the anatomy laboratory to permit students to consider (early in their training) diagnostic possibilities as a by-product of structural knowledge. Later in the clinical years students will come to develop the habit of using clinical anatomy to recall an orderly, extensive list of diagnoses.

Medical educators at times appear to be insensitive to the impact of research on medical students. Layer upon layer of newly discovered facts join the student's academic load as more and more exquisite subcellular ultrastructures become unraveled. This data overload leads to frustration and a sense of futility, and students frequently react by cultivating the art of faking answers as a substitute for true reasoning. When quizzed in the clinical setting students often prefer to guess rather than admit they do not know. Medical educators are largely responsible for this "feigned" reasoning, because basic scientists and clinical subspecialists alike ply students with much clinically irrelevant material. It is tacitly understood by both students and their teachers that the posture of not knowing is unacceptable.

It is time for medical educators to develop a reasoned, global approach for the management of clinical data. It is suggested a workable method would divide all clinically oriented information into two categories: emergent and elective. This "bicameral" imperative requires all physicians to know certain critical facts. For example, doctors must master fundamental principles of resuscitation and emergency treatment, basic signs and symptoms, and the clinical anatomy germane to the performance of a thorough physical examination. Elective information includes data related to classifications, percentages, eponyms, and other facts readily found in texts or at the computer terminal. This bicameral proposition should be substituted for the notion that students can learn endless data from disconnected disciplines.

The proposed scheme of teaching what may be called "clinical" pathology in the anatomy laboratory would follow a consideration of signs, symptoms, and diagnostic possibilities related to the area under consideration rather than from structural issues alone. Clinical anatomy, and an ability to establish a diagnosis—particularly in the acute setting—is essential and therefore emergent and fundamental for all physicians. This approach leads students to think structurally and to employ visual imagery early in their training when learning to differentiate emergent priorities.

Therefore, it also seems reasonable to consider teaching clinical anatomy in the order of its acute application. Thus, airway problems and the anatomy of portions of the head and neck and thorax might be taught first, including an emphasis on emergent, life-threatening events. This would establish firmly in the student's

mind the priority of events in the evaluation, resuscitation, and treatment of a patient regardless of specialty. At a minimum, at the end of the first year of medical school the student should be a skilled first responder who is able to provide life-preserving aid to the injured and the acutely ill. This emergent basis for learning clinical anatomy will reinforce memory as well as set the standard for establishing an anatomically based differential diagnosis.

First year medical students may have a marginal biologic background upon entering medical school. Clinical concepts such as shock must be simplified and should be approached anatomically. Thus, the student learns that blood circulates through the body by means of a series of specialized vessels, from the energy being provided by the contracting heart. Shock syndromes are easily understood and remembered as defects in the components of this system: cardiogenic shock (pump), hypovolemic shock (blood, plasma, fluid, and electrolytes), neurogenic shock (vessels), septic shock (all components). Also, less emergent diagnostic possibilities are taught as each region of the body is dissected.

The idea of introducing clinically relevant pathology into the first year anatomy course is not new. However, rather than emphasizing the importance of the necropsy or specific pathologic diagnoses (Metcalf et al., 1971), the suggestion is made here to encourage the student to ask of each anatomic area, "What can happen to these tissues?" At the first year level, the answer must include an emphasis on categories. It seems clear from case presentations and group discussions with third year medical students that early exposure to pathologic possibilities would permit easier recall and management of the detailed pathologic data encountered later.

However, the laboratory dissection should not be the only focus for teaching clincial pathology. Lectures should begin by introducing the anatomic region under study through the consideration of a few dominant symptoms. For example, the thorax may be studied from the perspective of chest pain as well as respiratory distress as previously mentioned. Students may be taught to think of chest pain in terms of a cardiac or non-cardiac origin with further subdivisions of each category according to the anatomy of the thorax. The dissection of the thorax then becomes a search for structures of established clinical importance rather than the prodding of obscure tissue buried within a cage that the student never expects to enter again. Memory is enhanced by welding together clinical anatomy and pertinent pathology.

When third year medical students are asked how they establish the differential diagnosis of a specific surgical problem they frequently respond,"I was trying to think about what's there." It is worthwhile in our teaching to cultivate the art of visual imagery of structures deep to the skin that is being palpated. This seems more reasonable than providing the student with a "laundry list" of disconnected diseases for every conceivable clinical problem encountered in each specialty. In the anatomy laboratory, visual, verbal, auditory, and kinesthetic sensations may enhance memory during the act of dissection. Wasteful intervals in the laboratory would be replaced with clinically oriented vocabulary expansion during the learning of broad-based schemes of differential diagnosis.

In contrast to learning differential diagnosis based upon structure many texts and journals now emphasize the use of complex algorithms. Clinical algorithms

TABLE 1. Structural basics: non-specifics before specifics

The living tube
Components of a solid organ
The limb prototype
Spaces: real and imagined
Neuromuscular units
Cross-sectional representation

seem to be replacing the reality of a knowledge of the areas involved in disease. Concomitantly, the physican-patient interface established by the laying on of hands is increasingly subverted to the intellectualizing of clinical problem-solving in the absence of patient contact. This is particularly true in the high-technology arena of critical care medicine.

What ultimately fails the student in the ensuing clinical years is an adequate memory of certain organ relationships which may effect the clinical presentation of disease. In fact, the student may avoid certain portions of the dissection such as the perineum and may thus develop regional clinical incompetence. Therefore, cadaver dissection must be preserved as a learning tool, for it seems that the act of dissection breaks down the student's culturally acquired disdain for certain anatomic areas. A curriculum devoid of dissection is devoid of reality. Misdiagnosis of proctologic disease, for example, frequently occurs because of a reluctance to perform a digital rectal exam wedded to anatomic ignorance. This may be referred to as the "paradox of the perineum": complicated anatomy subverted to superficial examination and trivial treatment.

Another vital concept is the teaching of non-specific structural units (Table 1) such as the living tube, components of a solid organ, the limb prototype, neuromuscular units, and cross-sectional representations. If structural units are taught as non-specific entities which react to disease in specific ways, then repetitive learning of a multitude of diseases may be eliminated. For example, whether the "living tube," assailed by seemingly disparate disorders, is the gut, the common bile duct, the ureter, or the fallopian tube, treatment decisions are based upon a few key pathologic processes. The final common pathway pathology for the living tube (Table 2) include the three "B's—bursting, blocking, bleeding" (R. Ger, personal communication), the mnemonic for perforation, obstruction, and bleeding, as well as inflammation, ischemia, and cancer. First year students familiar with non-specific structural units may anticipate much of what will appear in specialty texts and develop reliable clinical decision-making skills. The living tube as a structural

TABLE 2. Indications for surgery on a living tube

Category	Pathology	Clinical mnemonic
Emergent	Perforation	"Burst"
	Obstruction	"Block"
	Hemorrhage	"Bleed"
	Ischemia	
	Inflammation	
Elective	Cancer	
	Intractable pain	

TABLE 3. A mnemonic for a differential diagnosis: "TIN VAN MAN DDF"

T	traumatic	M	metabolic (endocrine)
I	inflammatory	A	autoimmune
N	neoplastic	N	nutritional
V	venous	D	developmental
A	arterial	D	deficiency
N	neurological	F	functional

non-specific unit thus becomes the common final pathway to understanding specific disease presentations.

Fundamental concepts of disease such as trauma, inflammation, neoplasia, and others may be introduced as part of a cross-referenced system for problem-solving in which anatomy serves as the second co-ordinate. A simple mnemonic to aid the recall of pathologic possibilities may be used to give students a starting point in working through an unfamiliar clinical problem. Such an etiologic mnemonic outlines most pathologic possibilities and literally permits the student to anticipate diagnoses as yet not encountered. For example, the mnemonic TIN VAN MAN DDF (Table 3) refers to virtually all common pathologic processes as well as unusual diagnostic possibilities unlikely to be recalled by the student.

The emphasis must focus on categories and concepts of disease, not specific entities. In a sense this approach might allow medical students to anticipate with genuine motivation the second year in-depth course in pathology.

REFERENCES

Cope, Z. 1921 The Early Diagnosis of the Acute Abdomen. London: Oxford University Press.

Metcalf, N.F., W.K. Metcalf, and D.J. Moffatt 1971 Early introduction to pathology. Lancet *ii*:1099.