Anatomy Correlations: Introducing Clinical Skills to Improve Performance in Anatomy

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Background and Objectives: Gross anatomy is one of the preclinical cornerstones of medical education, but many practitioners feel that medical students’ knowledge of anatomy is inadequate. To help students understand the clinical relevance of anatomy studies, Ohio State University faculty developed a course called “Anatomy Correlations.” This course introduces students to basic physical examination techniques correlated to gross anatomy dissections and allows them to practice techniques learned. Methods: Anatomy grades prior to the introduction of the course were compared with anatomy grades after the introduction of the course to see if the course improved knowledge of gross anatomy. Analysis controlled for initial differences in academic aptitude. Results: Students taking the course in its new form scored higher in anatomy than did students taking anatomy before the course was offered. Conclusion: Introducing physical examination skills that correlate with anatomy studies can lead to improvement in anatomy scores.

The first 2 years of medical school are traditionally spent focusing on the basic science curriculum, one of the cornerstones of which is gross anatomy. The study of gross anatomy has long been seen as one of the most relevant aspects of preclinical training. Despite its relevance, some practicing clinicians feel the anatomical knowledge of medical students is inadequate and below the level necessary for safe medical practice. Medical educators are thus challenged to find innovative ways to ensure that students have a strong knowledge base in anatomy before they begin their clinical training.

Rolfe and Sanson-Fisher identified 10 principles underpinning effective clinical learning. One of these principles is “relevance aids learning.” Prior studies have supported the idea that learning is context sensitive and that active learning is superior to memorization. In the field of medical education, learning through practice and repetition with standardized or actual patients can help students with long-term recall. Exposure to clinical scenarios will help students faced with similar clinical scenarios in the future.

The idea of making material more relevant can be applied to the study of gross anatomy. Pandey and Zimitat discovered that successful students learn using both surface and deep learning approaches. Surface learning is typically done through rote memorization, and successful students need to combine this with visualization and/or understanding to achieve deep learning. Pandey and Zimitat defined understanding as “seeking a structure within the material and manipulating the information to make sense of it in relation to what is known of the subject matter.” Exposing students to the clinical application of the anatomy may add to memorization and help develop a deeper understanding. Thus, the study of anatomy may become more relevant to the students’ future career as a practicing clinician if correlated to clinical information. This concept was demonstrated by Navsa and colleagues in a study of dentistry students learning head-and-neck anatomy. Students were exposed to cadaver specimens, radiographic images, and clinical case scenarios and reported that the integration improved their understanding of anatomy, stimulated them to study anatomy, and increased their interest in their future careers as dentists.

Based on this information, the Anatomy Correlations course has been created at Ohio State University College of Medicine for all first-year medical students. The goal of the course is to facilitate understanding of gross anatomy through the introduction of physical examination skills. In addition, this early exposure to a clinical (or standardized clinical) situation gives the students the opportunity to “act” like a physician.
Background

Standard Curriculum

The purpose of this investigation was to determine if average grades in anatomy have improved since the addition of the Anatomy Correlations course into the educational program. Study methods were reviewed and approved by the Ohio State University Institutional Review Board.

At Ohio State, gross anatomy training occurs at the beginning of the first year. In general, each session within a block begins with a 1-hour lecture followed by a 3-hour group dissection. Tests occur after each 4-week block of sessions and include written and practical components.

Physical Examination (PE) is taught at the beginning of the second year as part of the Physician Development course (Table 2 outlines the components of the course). PE consists of five 3-hour small-group sessions with 12–14 students per faculty facilitator. Students meet weekly. Sessions follow a demonstration-practice format with students observing the skills and practicing on one another. To standardize content and technique, faculty members take part in a 2-hour development session before teaching the course.

In the PE course, skills are taught in a systems-based format. The topics for each of the five sessions are (1) general appearance, vital signs, head and neck, (2) neurologic, (3) thorax, (4) abdomen and musculoskeletal, and (5) cardiovascular.

Male and female genitourinary examination is taught later in the year. A comprehensive checklist of skills is used to guide students and faculty. Students are evaluated by their facilitator, and this grade is a component of their grade for Physician Development.

Anatomy Correlations

The Anatomy Correlations course was developed in 2003 to offer first-year students an opportunity to learn basic physical examination techniques to better take advantage of clinical opportunities offered to them throughout their preclinical years. The objective of the course was that students would gain a deeper understanding of physical examination techniques if the learning was correlated with anatomical structures. For example, if students visualize the heart in the thorax during dissection, they may better appreciate the need to auscultate in the appropriate locations during physical examination. The skills taught are basic and not intended to replace the more-detailed physical examination course given in the second year.

The objectives for Anatomy Correlations were developed to parallel the gross anatomy curriculum and are listed in Table 2. This course is given concurrently with Gross Anatomy, and no specific changes were made to the Gross Anatomy course as a result of the addition of Anatomy Correlations to the curriculum.

In Anatomy Correlations, physical examination techniques are introduced to the students in a half-hour large-group lecture and demonstration led by one of the course directors. In the first year (2003), due to program director time constraints, this material was presented through video. Since 2004, the material has been presented in live, interactive presentations. The physical examination lecture and demonstration occurs 2 weeks into each 4-week gross anatomy block. This is done so that the students will have performed cadaver dissections on most of these organ systems prior to the lecture on clinical skills.

The students also practice the physical examination techniques on their peers during an hour-long small-group session facilitated by fourth-year medical students. The fourth-year students are recruited for these sessions and paid for their participation. Student instructors are trained in a 2-hour session conducted by the course directors. During this session, student instructors review physical examination techniques and learn methods for classroom management and appropriate delivery of feedback.

The Anatomy Correlations practice sessions occur the day of the large-group lecture for half of the class and 2 days after the large-group lecture for the other half of the class. Each small-group session begins with a review and demonstration of the individual physical exam components, followed by practice time for each skill. This allows the fourth-year students to provide feedback to each student as they demonstrate proficiency. On average, fourth-year students are facilitating small groups of 14 first-year students.

Students are formally assessed through a standardized patient examination that occurs on the day of each Gross Anatomy examination. Students participate in
four standardized patient encounters for each block. During each encounter, the student reads a brief clinical scenario and set of instructions prior to entering the examination room. The student then enters the room and performs the defined set of skills for that clinical scenario. Students have 2 minutes in which to complete the encounter. Standardized patients use a checklist to evaluate each skill performed and are trained by the course directors to ensure consistency in evaluation. To introduce students to their role as medical professionals, professional attire (including a white coat) is required, and standardized patients are required to grade each student on professionalism. An example of a clinical scenario given to a student and the checklist given to the standardized patient is shown in Table 3. The final scores of each encounter are tallied, and the combined score for all four sessions makes up the Anatomy Correlations component of the students’ Physician Development grade.

The standardized patients used for the course are recruited through the clinical skills center and are selected from a pool of standardized patients who are used for various educational experiences at Ohio State University. For each session, the standardized patients are trained in a 1-hour training session led by the course directors. Each of these training sessions occurs the week of the examinations to ensure that the standardized patients have appropriate time to learn and retain the skills to be evaluated. Standardized patients are paid $14 per hour for their work, and the clinical skills center has 12 rooms available for use. All 210 students in the class can be tested in 5–6 hours.
Results

Table 4 shows the descriptive statistics of each entering class. Table 5 displays the results of the one-way analysis of covariance (ANCOVA).

Results of the ANCOVA indicate a significant difference between entering classes on the composite Anatomy score while controlling for initial differences in academic aptitude. Post-hoc tests indicate that the source of this difference is found between the initial three entering classes and the subsequent three classes. The initial two entering classes were not exposed to the Anatomy Correlations course, and the third class was introduced to the course, but the large-group lectures were shown by video instead of a live lecture. The last three entering classes were exposed to the current form of in-person anatomy correlations. Students who had the Anatomy Correlations course, in its current form, scored higher in Anatomy than their counterparts who took Anatomy before the introduction of the course or before it was fully developed.

Discussion

The introduction of clinical skills in the Anatomy Correlations course resulted in a small, but statistically significant, improvement in Gross Anatomy grades. Since the Anatomy Correlations course does not include a specific anatomy review, but rather focuses on specific skills (taking a blood pressure, using a stethoscope, etc), one would not expect this improvement to be a result of more curricular time spent learning anatomy. It is not clear, however, that this intervention alone (ie, the Anatomy Correlations Course) was responsible for the improvement in Gross Anatomy grades. We did try to take into account some variables that may have contributed to the difference in grades but were not able to take all factors into account. Previous experience in a Gross Anatomy course and time spent studying the Gross Anatomy material was not taken into account, nor was performance of fourth-year students as facilitators in the small-group sessions. No attempt was made to standardize the small-group experience, and variability in teaching skills of the fourth-year students was not assessed. Further, while the Gross Anatomy course has not undergone any major curriculum changes, one would expect minor year to year variations that have not been accounted for. Consistency among the standardized patients with respect to their ability to correctly score the exam skills performed by the students was also not evaluated, though literature supports the fact that standardized patients can be trained to properly evaluate clinical skills.9,10

The inclusion of formal physical examination skill training during the anatomy portion of the first year should yield an improvement in clinical performance in students as they develop into physicians. However, these effects will have to be tracked in a longitudinal fashion.

Another point of discussion is student satisfaction with the course. The course has been evaluated by the students each year and while many students seem to enjoy the course, others feel that it is simply a distraction to their other studies. The latter group feels that the standardized patient encounters take up time and energy during their study of gross anatomy and have suggested that these encounters be given on a different day than the gross anatomy examination. Another unintended consequence is that many students feel like the comprehensive physical examination course given during the fall of the second year is repetition, and thus interest has waned. Many faculty members who teach the physical examination course have commented on this finding. On the other hand, other faculty members

<table>
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<th>Entering Class</th>
<th>n</th>
<th>Mean</th>
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<tr>
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<td>83.61</td>
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<tr>
<td>2002*</td>
<td>191</td>
<td>84.24</td>
<td>7.13</td>
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<tr>
<td>2003**</td>
<td>207</td>
<td>83.02</td>
<td>7.35</td>
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<tr>
<td>2004***</td>
<td>203</td>
<td>85.93</td>
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<tr>
<td>2005***</td>
<td>202</td>
<td>85.48</td>
<td>6.42</td>
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<tr>
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<td>190</td>
<td>86.01</td>
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<tr>
<td>Total</td>
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<td>84.71</td>
<td>7.05</td>
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SD—standard deviation
* Standard instruction
** Anatomy correlations by video
*** Anatomy correlation by in-person instruction

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<th>Df</th>
<th>MS</th>
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<td>703.33</td>
<td>15.39**</td>
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* With Entering Class as the independent variable, Anatomy Composite Score as the dependent variable, and MCAT Quantitative Composite Score and Undergraduate GPA as the covariates
** p < .001

SS—sums of squares
Df—degrees of freedom
MS—mean square
comment that the objectives for the second-year physical examination course can be covered in much more detail since the student begins the course with a basic level of knowledge.

Conclusions
Introducing physical examination skills that correlate with anatomy studies may lead to a small improvement in anatomy scores. This supports earlier research that clinical relevance aids learning and may have implications for other components of medical school curriculum. Future studies should continue to explore this idea in a more controlled fashion. In addition, research should be done to determine whether the early introduction of clinical skills leads to additional benefits as medical students enter the clinical realm of the third and fourth years of medical school.

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References