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ORIGINAL RESEARCH

Extent of Utilization of Radiologic Images in Gross Anatomy Teaching, the Experience of Ethiopian Medical Schools

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Background: One of the greatest developments in modern medicine is the strides taken in radiology. Today, thanks to high-tech devices like computer tomography (CT), magnetic resonance imaging (MRI), and ultrasound, a noninvasive glimpse into the human interior has been made possible. These recent developments have revolutionized how doctors see anatomy. To keep pace with this progress, many medical school anatomy curriculums have undergone a facelift. In these new curriculums, radiology has been presented as a practical and sufficient alternative tool for learning anatomy. This study, therefore, aimed to determine the extent of the use of radiologic images in the teaching of anatomy in Ethiopian medical schools.

Methods: An online questionnaire was used to collect, compile and analyze data from anatomy instructors in Ethiopian medical schools.

Results: The survey showed that 55.9% of the instructors used radiologic images of one form or another in their teaching. However, it also revealed radiological images comprise <5% of the total images used in teaching. The majority (73.5%) of the instructors lacked any prior training or coursework in radiologic anatomy. Despite full-time radiology faculties existing in the schools, a relationship between the anatomy and radiology department is virtually unheard of.

Conclusion: The curriculum currently in use in Ethiopian medical schools is designed in a way both vertical and horizontal integration of the traditional subjects are achieved. This way, the introduction of clinical medicine early will provide context and relevance to the learning of basic science. Despite the curriculum's emphasis, we have observed limitations in the degree of integration of anatomy and radiology.

Keywords: radiologic images, radiologic anatomy, gross anatomy, undergraduate medical curriculum

Background

Medicine is an ever-changing field, but the significance of anatomy in clinical practice has stood the test of time.[1–4] Anatomical knowledge is fundamental one has to gain in order to master clinical arts ranging from the basics of physical examination to the extremes of performing complex invasive procedures.[3]

Despite its importance, clinicians find clerkship students' basic anatomy knowledge poor.[1,2,5] A guest editorial note in the journal of Canadian radiologists once stated, "Senior medical students completing radiology rotations sometimes struggle to recall the basic elements of first-year anatomy".[6]

Students attribute this to information overload, the need to translate between multiple dimensions, and the lack of clinical correlations in the teaching.[7,8] These learning challenges are further aggravated by the tides currently hitting the Anatomy world. The community has been struggling with the scarcity of anatomists, the enormous size of students, and the lack of funding for acquiring enough cadavers.[3–5,9]

The ordeals of 21st-century anatomy are not limited to these. The further advent of new technologies has revolutionized how doctors scrutinize patients' interiors.[5,10] Despite surgeons and a few other specialties still getting acquainted

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with cadaver-like tactile anatomy; radiology has now become the primary venue for anatomy.[5,11] Computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography by offering super tissue resolution have made a noninvasive glimpse into the brain, viscera, vasculature, and developing fetus possible.

This has come with its own challenges to the curriculum. For instance, the invention of CT and MRI has put much emphasis on cross-sectional anatomy.[12] A topic seldom discussed in classes in the past. We often used to train doctors on the heart's anatomy, by either using cadavers or models. But, echocardiography is how close they would ever be in practice.

At the dawn of these millennia, the mentioned dynamics of development in medicine, the challenges in anatomy teaching, and the perceived deficiencies in the young graduates culminated in a global call for a facelift in the anatomy curriculum. This resulted in a shift from traditional didactic to more clinical-oriented problem-based learning.[5,10,13,14] unsurprisingly, one landmark of the new anatomy curriculum was an emphasis on radiologic anatomy.

This emphasis via the re-engineered anatomy curriculum helped students increase interest in the subject.[5,12] It also helped students gain a thorough understanding of anatomical spatial relationships in multiple planes.[16,17] Improvement in course scores.[12,14] And development of professional competency were noted.[9]

The utilization of radiological images is a favored instructional format by students. Rizzolo et al revealed that 80% of students liked the concept of radiologic anatomy.[18] Radiology, by bridging the gap between anatomy and clinical medicine, provides the raison d'être of the course to the students.[14] Studies were also done to assess the effectiveness of radiologic images in gross anatomy teaching; they concluded, that integrating anatomy instruction with radiologic imaging was an effective approach for teaching students.[15,19]

However, despite best practice guideline recommendations from medical organizations such as the Association of American Medical College, the General Medical Council and the Royal College of Physicians and Surgeons of Canada, the role medical images play in teaching gross anatomy is not standardized, its weight varying among and even within countries.[20–22]

Research on the issue has been done in North America, Europe, and a few Asian countries but there is a paucity of information regarding medical schools in Africa and the rest of the developing world. This study, therefore, aimed to determine the extent of the use of radiologic images in the learning of anatomy in Ethiopian medical schools. Ethiopia, where this study has taken place, has undergone a major transformation in medical education; increasing its public medical schools from 5 to 28 in a relatively short time. Its annual medical school admission also has increased from the hundreds to thousands. In a state of rapid expansion, it is only natural to assume the existence of challenges.

Methods

We carried out the study in the school of medicine of Dire Dawa University. After reviewing of literature, we designed a questionnaire that used an online google survey program. Through the Ethiopian anatomical society, we identified individuals currently offering gross anatomy to medical students. We invited those identified to participate in our survey. Once the identified individual had agreed to participate in our survey, an e-mail was sent directing them to the Web site that hosted our survey. The Web site was used to collect responses, compile, analyze and display results.

Results

Among 28 public medical schools found in Ethiopia, 20 took part in the survey. Of 42 anatomists available in these medical schools, 34 responded to the survey questions, making a response rate of 80.9%.

Regarding experiences of the anatomists in teaching gross anatomy to medical students, the majority (55.9%) had an experience of 4–6 year, 32.4% had an experience of 1–3 years, 8.8% had an experience of 7–8 years, and 2.9% had an experience of greater than 10 years. Regarding academic rank, 67.6% were lecturers and 32.4% were Assistant professors.

Regarding the delivery time of anatomy to medical students, the majority of medical schools teach anatomy in the first and second year.

When asked if they had any training or course in radiologic anatomy, the majority (73.5%) said No. the rest (26.5%) had taken a course in their post-graduate studies.

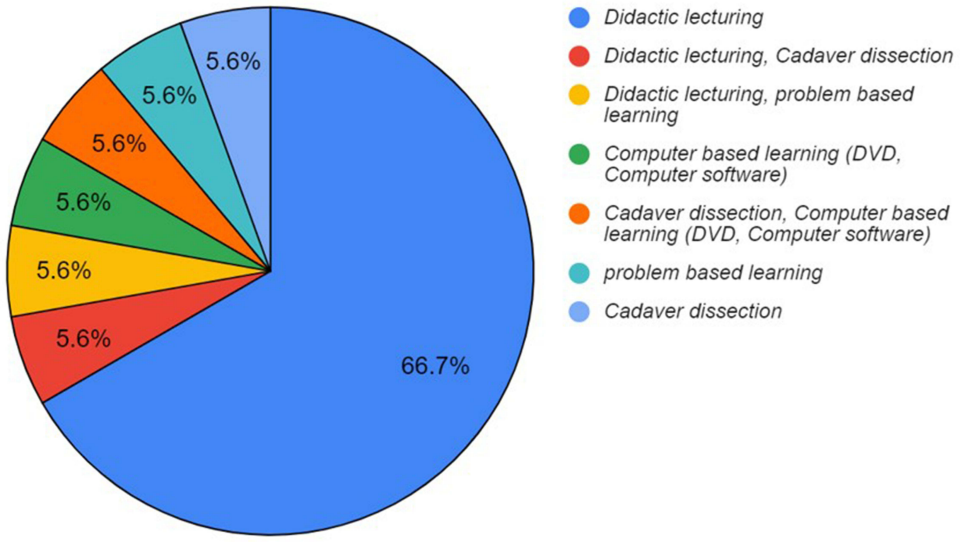

Figure 1 Radiologic image usage with respect to teaching methodology.

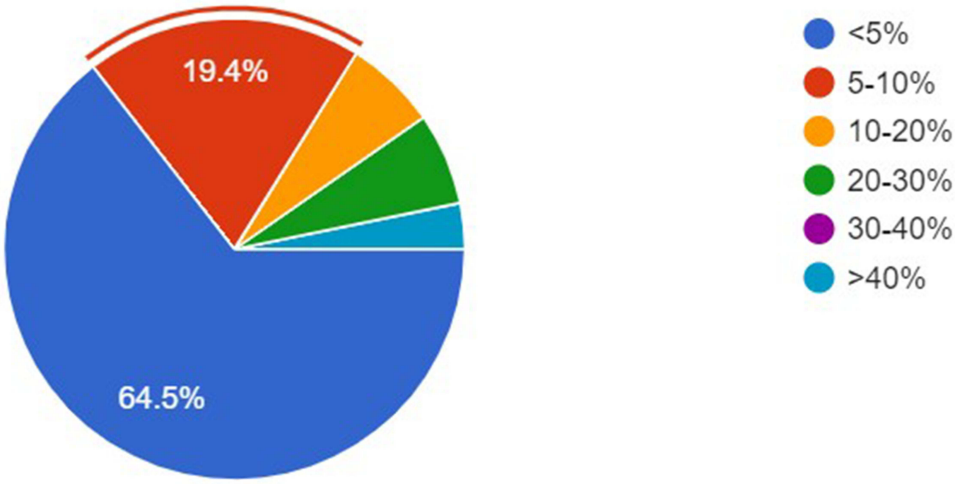

Figure 2 The relative proportion of radiologic images when compared to total images used to teach.

Regarding utilization of radiologic images in teaching gross anatomy, 55.9% used radiologic images in teaching. Most used images in didactic lecturing (66.7%) and others (5.6%) incorporated them into problem-based learning (PBL). (Figure 1) When asked what percent of images used in teaching are radiological; the majority (68.4%) stated <5%. (Figure 2)

Regarding the preferred radiologic modality based on the utilization in teaching, the majority 15 (44.2%) ranked X-ray high. MRI 5 (14.7%), ultrasound 4 (11.7%) and CT-scan 3 (8.8%).

Regarding the provision of a computer/web-based resource to their students, 44.1% confirm availability. Of those providing the resource, the majority stated offering dissection videos or online lectures.

Regarding the availability of Radiologists in their schools, the majority (72.2%) stated having full-time Radiologists in their medical schools. However, they noted a lack of relationship between the Radiology and Anatomy departments. Almost all responded that the Radiologists had no contributions to teaching Anatomy to medical students.

Discussion

Radiological imaging has revolutionized the means of studying patients' anatomy. In parallel, it is important that our anatomy teaching adjusts to that context. It's alarming that our survey has found only slightly higher than half of the

medical schools reported the incorporation of radiologic images in their teaching; even among those, limitations both in extent (responsible for <5% out of the total teaching images) and variety observed.

There are many existing resources on the Internet for studying anatomy.[9,12,23] For example, a study by Choi et al evaluated electronic resources and reported that there were over 100 educational Web sites focused on teaching anatomy.[24] Despite many Ethiopian institutions offering web or computer-based learning, we have found the majority are online lectures or dissection videos. Despite, this being helpful in schools where cadaver is in short supply, it comes with an inherent limitation. A study has shown Students often cannot appreciate arbitrary planes and structural relations in such demonstrations.[23]

Providing students with Radiological digital teaching files/webs that are organized in ways making multidimensional (axial, sagittal, and coronal) visualization possible would help in alleviating this shortcoming. These files have become increasingly easy to develop with picture archives and communication systems (PACS).

One other important finding of our survey is the lack of relationship between anatomy and radiology departments. The importance of establishing relations between these two has been discussed in literatures.[9,13,17,25] Beginning medical students appreciate the clinical insights provided by radiologists. Radiologists can provide students with a clear grasp of why knowing anatomy is relevant. The radiology department could also help in providing medical images.

Conclusion and Recommendation

Despite the nationwide used medical school curriculum developed by the consortium of medical schools in Ethiopia allocating significant sessions for radiologic anatomy; this survey revealed the role it plays to be limited. The study has also shown most instructors lacked prior training in radiologic anatomy. We, therefore, recommend the concerned authorities provide continue medical education on radiologic anatomy.

Abbreviations

MRI, magnetic resonance imaging; CT, computer tomography; PACS, picture archiving & communication system.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval and Informed Consent

Informed consent was taken on the online survey, ethical approval was granted by Dire Dawa University's institutional review board with Reference no.0029/2014.

Consent for Publication

Consent for publication was taken and agreed to publish.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare they have no competing interests including financial and non-financial.

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