Does the existing traditional undergraduate Anatomy curriculum satisfy the senior medical students? A retrospective evaluation

O currículo tradicional de Anatomia é satisfatório para os estudantes do último ano de medicina? Uma avaliação retrospectiva

Zahid Ali Kaimkhani¹, Masood Ahmed², Musaed Al-Fayez³, Muhammad Zafar⁴, Asad Javaid⁵

ABSTRACT

Objective: To present the results of a study concerning views and feedback from the interns and medical students about the Anatomy Curriculum, as well as their suggestions to design a Clinical Core Course in Anatomy. Methods: Interns at the end of their clinical year and medical students at the end of their final year were asked to evaluate the Anatomy Curriculum that they experienced in their undergraduate pre-clinical years. Results: Most respondents found that the duration of gross anatomy taught was adequate, but the vast majority expressed clinical anatomy, imaging anatomy, and surface and living anatomy courses as too short. Interns and medical students ranked anatomy courses and integrated clinical topics as keystone for their clinical training and felt the need of clinically oriented anatomy, case studies and participation of clinical faculty in pre-clinical years. Conclusions: Retrospective evaluations at the end of internships and final-year of under graduation are helpful “evidence” to be considered in reforming the anatomy curriculum, particularly in developing clinical core course in anatomy. The results of such studies should be taken into consideration when discussing modifications to anatomy curriculum.

Keywords: Anatomy/education; Curriculum/standards; Education, medical, undergraduate/standards; Physicians/psychology; Questionnaires; Students, Medical; Teaching/methods; Teaching/standards

INTRODUCTION

Traditional medical school curricula have made a clear demarcation between the basic biomedical sciences and the clinical years(1). Human anatomy is one of the fundamental subjects in a medical curriculum, but the time assigned for...
the teaching of anatomy to medical undergraduates has been substantially reduced both in USA and in Europe(2-3). Despite reductions in the importance, time committed to, and status of anatomical education in modern medical curricula, anatomical knowledge remains a cornerstone of medicine and related professions(4). As a result of this restriction, numerous attempts have been made to adapt the organization and occasionally the content to the altered circumstances. All aspects of anatomy have been reduced irrespective of vocational relevance(5). Despite these attempts, the role of anatomy within the medical curriculum is increasingly contested(6-7). Anatomists are, therefore, presented with the challenge of delivering required levels of core anatomical knowledge in a reduced time-frame and with fewer resources(6).

In an attempt to provide guidance to decision-makers involved in clinical anatomy curriculum development at the medical school level, the Educational Affairs Committee of the American Association of Clinical Anatomists (AACA) developed a document defining the contours of an anatomy curriculum leading to medical doctor or equivalent degree(8).

Since problem-based medical teaching with hybrid type of curriculum, where traditional lectures that have less weight are on the way in several lately opened medical schools in Saudi Arabia, a hot debate has been generated on whether the traditional system satisfies the required objectives of imparting the sound knowledge of Anatomy required for clinical skills and reasoning. The recommendations by the AACA(9) were the cornerstone to review the existing anatomy curriculum. Several steps at discussion level seem to be necessary in the medical faculty to start a new curriculum(9-10). It is believed that, while debating the relevance of different subjects in the undergraduate medical curriculum, the views of the medical students at the end of their courses should be included(11-12). In fact, the World Summit on Medical Education emphasized, in 1993, the need to involve students as partner in all levels of medical education, including planning, curriculum development and evaluation(13). The present study was carried out within this context.

The anatomical sciences have traditionally been taught as three separate courses: Gross Anatomy, Histology and Embryology in traditional medical schools, like the College of Medicine King Saud University Riyadh, Saudi Arabia. Here it is done by primarily utilizing a lecture and laboratory format. Each academic year runs from September to June, a period shorter than a full academic year. The anatomy course is a 390-hour (16-credit hours) course, distributed through four semesters in two preclinical years. Gross anatomy is a 287-hour (10-credit hours) course, Histology a 75-hour (3-credit hours) course and Embryology is a 28-hour (2-credit hours) “crash course”. Head and Neck (H&N) and Neuroanatomy are taught in the second preclinical year while all other regional (gross) anatomy, Histology and Embryology are taught in the first preclinical year. In the first preclinical year, each week students work for five hours in gross anatomy laboratory and for two hours in Histology laboratory, whilst in the second preclinical year, students spend two hours in gross anatomy laboratory. The Chart 1 provides an abbreviated version of the anatomy course program at the College of medicine, King Saud University.

**Chart 1. Course schedule and time allotted to anatomy course**

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Semester</th>
<th>Gross anatomy (287)*</th>
<th>Histology (75)*</th>
<th>Embryology (28)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>1st</td>
<td>General anatomy (3)</td>
<td>1 hour lecture:</td>
<td>Lectures</td>
</tr>
<tr>
<td></td>
<td>(15 week)</td>
<td>Upper limb (36), Thorax (34), Abdomen (part I) (Anterior abdominal wall, peritoneal cavity, intraperitoneal structures) (28), PBL (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>2nd</td>
<td>Abdomen (Part II) (21), Pelvis and perineum (32), Lower Limb (36), PBL (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(13 week)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>3rd</td>
<td>Head and Neck (45)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(15 week)</td>
<td>PBL (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td>4th</td>
<td>Neuroanatomy (42), PBL (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(13 week)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Number of hours is shown in parenthesis. PBL: problem-based learning

**OBJECTIVE**

To present the results of a study concerning the views and a feedback from the interns and medical students about the Anatomy Curriculum and their suggestions to design a Clinical Core Course in Anatomy.

**METHODS**

This study was carried out during the academic year of 2007-2008, at the Department of Anatomy, King Saud University. Self-administered questionnaires were distributed among interns and final-year medical students. They were asked to take a critical look at the relevance of their anatomy courses, ranking different regions and courses as “too short”, “adequate”, “too long”, or “superfluous” for their clinical years and/or internship. The gross anatomy course was divided into ten regions. They were also requested to suggest the means to improve the anatomy curriculum. Differences were calculated between interns and final-year medical students and between males and females.
RESULTS
A total of 355 answers were received after distributing 450 questionnaires, which corresponds to a response rate of 78.8%. There were 140 (70 %) interns and 215 (86%) medical students. Female were 24 and 37%, respectively. There were no significant differences between interns and final-year medical students. The main results are shown in Table 1.

<table>
<thead>
<tr>
<th>Anatomy courses</th>
<th>Too short (%)</th>
<th>Adequate (%)</th>
<th>Too long (%)</th>
<th>Superfluous (Unnecessary) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I General anatomy</td>
<td>49</td>
<td>47.5</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>II Regional anatomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoracic and Abdominal wall</td>
<td>7</td>
<td>75</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Thorax</td>
<td>12</td>
<td>78</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Abdomen</td>
<td>22.5</td>
<td>70</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Pelvis, perineum</td>
<td>25</td>
<td>65</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Extremities</td>
<td>8</td>
<td>63</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>Vertebral column, back</td>
<td>35</td>
<td>45</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Skull, Cranial cavity</td>
<td>16</td>
<td>68</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Face, Eye, Ear</td>
<td>15</td>
<td>74</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Neck</td>
<td>17</td>
<td>75</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Brain, Spinal cord</td>
<td>20</td>
<td>65</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>III Living and surface anatomy</td>
<td>72</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV Imaging anatomy</td>
<td>56</td>
<td>38</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>V Clinical anatomy</td>
<td>54</td>
<td>36</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>VI Developmental anatomy (Embryology)</td>
<td>25</td>
<td>58</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>VII Microscopic anatomy</td>
<td>15</td>
<td>61</td>
<td>23</td>
<td>1</td>
</tr>
</tbody>
</table>

The first question was whether the intense time they spent in learning anatomy was necessary; 91% of the participants voted for “yes”.

The second question dealt with the different courses taught in anatomy. Concerning gross anatomy, 45 to 78% of respondents ranked as taught “adequately”, 7 to 35% as “too short” and 5 to 27% as “too long”.

Surprisingly, most respondents (72%) ranked the living and surface anatomy as “too short”, only 20% as “adequate” and 3% as “too long”. Clinical and imaging anatomy was considered “too short” by more than 50% and “adequate” by about 35%. On the subject of general anatomy, nearly an equal percentage of participants ranked as “adequate” and “too short”, and 3% as “too long”.

The embryology course was ranked as “adequate” by 58% and almost an equal percentage ranked as “too short” and “too long”, whereas 61% judged microscopic anatomy taught as “adequate”, 15% as “too short” and 23% as “too long”, but hardly any respondent considered living anatomy, surface anatomy, imaging anatomy, clinical anatomy and embryology as “superfluous”, differently of microscopic anatomy and many regions of gross anatomy.

Another question was whether the development of the nervous system and head and neck should be taught in the first or second year; most (68%) of the students voted for the second year.

Among the suggestions for improving the anatomy curriculum, 63% of respondents asked for more clinically-oriented topics, more problem-based learning (PBL) and case studies (41%), more living and imaging anatomy (43%). A total of 21% suggested review lectures on development of nervous system and head and neck in the second year, whilst 18% suggested for lectures by clinicians.

DISCUSSION
Human anatomy gives the foundation for clinical medicine, thus its place in the medical syllabus deserves careful attention. Despite the information explosion from medical research and the rapidly expending diagnostic and therapeutic possibilities of medical technologies, effective health care still rests on a solid anatomical base; this includes the cornerstone of clinical diagnosis, the physical examination(14-15).

To our knowledge, this is the first study in Saudi Arabia asking interns and final-year medical students about how well their anatomy curriculum prepared them for clinical training. Students have often been asked to evaluate their anatomy curriculum, but this is normally done only right after the end of the course. At this early time, the students are unable to decide what knowledge of topographical anatomy, living anatomy, surface anatomy, imaging anatomy and microscopic anatomy are of clinical relevance. Pabst(11) surveyed final-year medical students for the relevance of anatomy course. Whereas, others(16-17) asked interns how well their medical syllabus prepared them for general medicine or postgraduate training, but not about the relevance of anatomy as a basis for clinical years of undergraduate training and internships. In this study, we asked both interns and final-year medical students to evaluate the relevance of the anatomy courses to their clinical years of undergraduate training and internships.

The results of this survey should not be over interpreted, but they are helpful to the discussion about how to modify the anatomy curriculum. A comparison of such data between countries should take into account the different legislation, number of students, admission criteria, etc., as partly summarized for Europe and the United States(18).
One striking fact to emerge from this investigation is that it clearly contradicts the tendencies, too much spread, considering that anatomy has become a branch that may be neglected in modern medical curriculum. A probably general outline has become apparent from this study, which would help the faculty in designing the core anatomy curriculum without endangering, but even improving, the basic knowledge necessary for clinical practice.

Most participants felt that the different regions of gross anatomy taught were “adequate”, but considered extremities as “too long and superfluous”. These findings are comparable to those of a survey with medical students at the end of undergraduate curriculum[11-12].

About 2/3 felt that surface and living anatomy taught was “too short” and required more time in the curriculum. Other investigators[19-21] also argued in favor of more surface and living anatomy. The results of this investigation fully support these suggestions. The physical examination of a person is the clinical application of surface anatomy[22-23]. The sessions of living anatomy also provide an indispensable background for most of the invasive procedures[24]. Similarly, a sound knowledge of surface anatomy has always been necessary for accurate radiography, as most of the radiographic central points have been based on surface anatomy[25].

With overall reduction in time assigned for teaching anatomy to medical undergraduates[2-3], the coverage of general anatomy seems to suffer maximum[26]. The present study also reflects this opinion. In the present curriculum, only three hours (Chart 1) are assigned to general anatomy, which were considered too short. General anatomy is the foundation of the whole subject of Medicine[26]. It introduces the student to the language of Medicine. Clear and concise communication with colleagues is an essential part of training in all fields of medicine. On of the objectives of any clinical anatomy curriculum should be the development of a vocabulary in anatomical terminology. The feedback in this study shows that more emphasis on general anatomy is needed in the reviewed curriculum.

Most interns and students felt that the clinical and imaging anatomy duration was “too short”. Pabst[11], in a survey, also found an obvious need for more clinical anatomy for undergraduate students. The majority of clinicians also felt that the current anatomical education of medical students is inadequate and below the minimum necessary for safe medical practice[27]. They often blame anatomists for teaching the students too many details instead of clinically relevant structures[11]. Actually, in anatomy, a well-known dilemma is faced with regard to the fact that when students have to assemble great quantity of body anatomical information, they are not aware of its application in clinical medicine. When they are ready to use anatomical knowledge, a substantial part of the information is forgotten[28]. Clinical anatomy applies the structural aspects of human biology to better understand the function and dysfunction of human body[24]. Proficiency in clinical anatomy requires an understanding of the whole human body anatomy and the ability to apply such knowledge to solve clinical problems[24]. There is wide spread support among clinicians for more vertical integration of anatomy teaching throughout the undergraduate curriculum[28]. The results of this survey also support the need for more clinically-oriented anatomy in the undergraduate curriculum.

A noteworthy observation is that more than half of the interns and students judged that imaging anatomy taught was “too short”. Imaging anatomy is an important part of learning material[29]. It is uncontested that sophisticated clinical imaging is an essential pathway to precise study of structure and how its maintenance[30]. Through the study of imaging anatomy, the medical student is able to use information learned in the anatomy laboratory to identify and understand the shapes and relationships of anatomical structures in a living subject. In some centers, classical dissection is enhanced by using ultrasound (US), tridimensional (3D) visualization, multiplanar computerized image reconstruction and multiplanar magnetic resonance imaging (MRI)[29].

The interns and students expressed a necessity of more PBL and case studies, considered as a valuable learning tool. Tavares and Silva[30] documented that students drew particular importance to case studies. The case studies or case-based teaching may not be introduced as a problem-based curriculum, as they were by Dinsmore et al.[28], but rather as representative of a compromise between a traditional non-dissecting educational approach and the introduction of imaging, sectional, and living anatomy, as reported by Tavares and Silva[30]. The introduction of case-based and more PBL and case studies will motivate the students to acquire self-directed learning skills as reported by Peplow[31].

The topographic anatomy of the head and neck and neuroanatomy are taught in the second year, whereas the developmental anatomy is taught in first year. Students point out the difficulty faced in comprehending the development of H&N and nervous system because of a gap between topographic anatomy and developmental anatomy of these courses. About 2/3 of the interviewed voted for second year and
about $\frac{1}{4}$ asked for review lectures in the second year. It is believed that students will benefit more from knowing the gross anatomy of the head and neck and neuroanatomy.

Most respondents were satisfied with microscopic and developmental anatomy courses, but a good percentage considered it “too short”. Pabst and Rothkötter\textsuperscript{(12)} also reported that resident ranked microscopic anatomy as necessary.

**CONCLUSIONS**

The evaluation of a medical curriculum should be a multistep procedure: the students should be examined and asked to complete questionnaires after different phases of the course, as well as when it ends, in order to retrospectively define the relevance of courses, as documented in this survey.

The results of this study clearly show that even medical students at the beginning of this century not only need cellular biology, but also a sound knowledge of anatomy.

Adding more living and clinical anatomy to new anatomy curriculum would motivate the students. Addition of a seminar living anatomy with patient presentation and videos on common clinical problems in each region will make the anatomy teaching more relevant. It could also motivate the students to learn the multitude of fact in anatomy.

In the new curriculum, anatomy courses may combine classic dissection with tools that the physicians and surgeons will use tomorrow. Students should be introduced to the newest technologies available for viewing the body with hands-on experience in the anatomy laboratory. The classical dissection may also be enhanced using ultrasound (US), tridimensional visualization, multiaxial computerized image reconstruction and MRI. It requires an interdisciplinary approach with surgeons, physicians and core anatomy faculty.

We suggest that residents at the end of residency and clinicians should also be asked to evaluate the undergraduate anatomy curriculum.

**REFERENCES**


24. McKears DW, Owen RH. Surface anatomy for radiographers. Bristol: John Wright and Sons Ltd. GB; 1979.

