Original research paper

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

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Abstract

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 they had experienced in their undergraduate pre-clinical years. Most of the respondents found that the gross anatomy taught to them was adequate but the vast majority expressed that clinical anatomy, imaging anatomy and surface and living anatomy were inadequate. Both interns and medical students ranked anatomy courses and integrated clinical topics as the keystone for their clinical training and felt the need of a clinically oriented anatomy curriculum, case studies and participation of clinical faculty members in teaching during the pre-clinical years. Retrospective evaluations at the end of internships and the undergraduate years are helpful "evidence" to be considered when reforming the anatomy curriculum, and in particular when developing a clinical core course in anatomy. The results of such surveys should be taken into consideration when discussing modifications to the anatomy curriculum.

Keywords: Interns; evaluation; imaging anatomy

Introduction

Traditional medical school curricula have made a clear demarcation between the basic biomedical sciences and the clinical years (Elizondo & López, 2008).

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Human anatomy is one of the fundamental topics in a medical curriculum, but the time assigned for the teaching of anatomy to medical undergraduates has been substantially reduced both in the USA and in Europe (A.A.C.A., 1966; Whitteridge & Harris,1962). Despite the reduction in the importance, time committed to, and the status of anatomical education in modern medical curricula, anatomical knowledge remains a cornerstone of medicine and related professions (Gillingwater, 2008). 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 (Monkhouse & Farrell, 1999). However, despite these attempts, the role of anatomy within the medical curriculum is increasingly contested (Collins *et al*., 1994; Kénési, 1984). Anatomists are therefore presented with the challenge of delivering required levels of core anatomical knowledge in a reduced time-frame and with fewer resources (Gillingwater, 2008)

In an attempt to provide guidance to decision-makers involved in curriculum development in clinical anatomy at the medical school level, the Educational Affairs Committee of the American Association of Clinical Anatomists (AACA) developed a document which defines the contours of an anatomy curriculum leading to M.D. or equivalent degree (A.A.C.A., 1996). Since problem based medical teaching with a hybrid-type curriculum where traditional lectures have less weightage is seen being implemented in various recently opened medical schools in Saudi Arabia, a hot debate has been generated whether the traditional system satisfies the required objectives of imparting sound knowledge of anatomy required for clinical skill and reasoning. The recommendations by AACA (1996) were the cornerstone to review the existing anatomy curriculum. Several steps at discussion level seem to be necessary in a medical faculty to commence a new curriculum (Mann & Kaufman, 1995; Sefton, 1995). It is recommended that while debating the relevance of different subjects in the undergraduate medical curriculum, the views of the medical students at the end of their curriculum should be included (Pabst, 1993; Pabst & Rothkötter, 1996). In fact, the World Summit on Medical Education in 1993 emphasizes the need to involve students as partners in all levels of medical education including planning, curriculum development and evaluation (WFME, 1993). It is within this context that the present study was carried out.

The anatomical sciences have traditionally been taught as three separate courses i.e. Gross Anatomy, Histology and Embryology in traditional medical schools such as the College of Medicine, King Saud University, Riyadh, Saudi Arabia. Here it is done by utilizing primarily a lecture and laboratory format. Each academic year runs from September through to June. The anatomy course is a 390 hour (16-credit hours) course that is distributed through 4 semesters in two pre-clinical 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 & Neck and Neuroanatomy are taught in the 2nd pre-clinical year while all other Regional (gross) Anatomy, Histology and Embryology are taught in the 1st pre-clinical year.

In the 1st pre-clinical year, students work 5 hours at the gross anatomy lab and 2 hours in the histology lab each week, whilst during the 2nd pre-clinical year students spend 2 hours in the gross anatomy lab per week. Table 1 provides an abbreviated version of the anatomy course programme at the College of Medicine, King Saud University.

This paper presents the results of a study concerning views and 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 in the academic year 2007-008, at the Department of Anatomy, King Saud University. Self-administered questionnaires were distributed to both interns and final year medical students. They were asked to take a critical look back/analyse 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 10 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

After distributing 450 questionnaires, a total of 355 completed questionnaires were received, with a response rate of 78.8 %. There were 140 (70%) interns and 215 (86%) medical students. Females were 24% and 37% respectively. There were no significant differences between interns and final year medical students. The main results are shown in table 2.

Table 1: Course Schedule and Time Allotted to Anatomy Course

Number of hours are shown in parenthesis

Academic Year	Semester	Gross anatomy (287)	Histology (75)	Embryology (28)
1st	1st (15 week)	General anatomy (3) Upper limb (36), Thorax(34), Abdomen (part I)[Anterior abdominal wall, peritoneal cavity, intraperitoneal structures] (28), PBL (4)	1 hour lecture: 2 hours Lab	Lectures
	2nd (13 week)	Abdomen (Part II) (21), Pelvis & perineum (32), Lower Limb (36), PBL (2)		
2nd	3rd (15 week)	Head & Neck (45) PBL (2)	-----	-----
	4th (13 week)	Neuroanatomy(42), PBL(2)	------	-----

Table 2: Assessment of Anatomy Courses by Interns and Final -Year Medical Students (n=355)

Anatomy Courses		Too Short (%)	Adequate (%)	Too long (%)	Superfluous (Unnecessary) (%)
I	General Anatomy	49	47.5	3	0.5
II	Regional Anatomy				
	Thoracic and abdominal wall	7	75	18	-
	Thorax	12	78	9	1
	Abdomen	22.5	70	6	1.5
	Pelvis, perineum	25	65	10	-
	Extremities	8	63	27	2
	Vertebral column, back	35	45	15	-
	Skull, cranial cavity	16	68	15	1
	Face, eye, ear	15	74	11	-
	Neck	17	75	8	-
	Brain, spinal cord	20	65	14	1
III	Living and Surface Anatomy	72	25		-
IV	Imaging Anatomy	56	38	6	-
V	Clinical Anatomy	54	36	10	-
VI	Developmental Anatomy (Embryology)	25	58	22	
VII	Microscopic Anatomy	15	61	23	1

The first question was whether they appreciate that the intense time they spent in learning anatomy was necessary; 91% - voted for yes.

The second question dealt with the different courses taught in Anatomy. Concerning gross anatomy, between 45% - 78% of the respondents ranked the course as being taught “adequately”, between 7% - 35% as “too short” and between 5%-27% “too long”. Surprisingly, most of the respondents (72%) ranked the teaching of living and surface anatomy as “too short”, only 20% as “adequate” and 3% “too long”. Clinical and imaging anatomy were graded “too short” by more than 50%, and “adequate” by about 35%.

On the subject of general anatomy nearly equal percentages of the participants ranked it as “adequate” and “too short” and 3% as “too long”.

The embryology course was ranked as “adequate” by 58% and almost equal percentages ranked it as “too short” and “too long”, whereas, 61% judged the amount of microscopic anatomy taught as “adequate”, 15% as “too short” and, 23% “too long”. Hardly any respondent considered living anatomy, surface anatomy, imaging anatomy, clinical anatomy and embryology as “superfluous” which was in contrast with the responses for microscopic anatomy and many regions of gross anatomy.

Another question was whether the development of nervous system and Head and Neck region should be taught in the first year or in the 2nd year; most of the answers (68%) voted for 2nd year.

Among the suggestions for improving the anatomy curriculum, 63% of the respondents asked for more clinically oriented topics, more PBL and case studies (41%) and more living and imaging anatomy (43%). Twenty one percent suggested conducting review lectures on development of nervous system and Head and Neck in the 2nd year; whilst 18% also suggested lectures by clinicians.

Discussion

Human anatomy forms the foundation for clinical medicine; thus its place in the medical curriculum deserves careful attention. Despite the information explosion from medical research and the rapidly expanding diagnostic and therapeutic possibilities of medical technology, effective health care still rests on a solid anatomical base; this includes the cornerstone of clinical diagnosis - the physical examination (Willms *et al*., 1994).

We could not find any previous studies conducted 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 usually this is done at 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 (1993) surveyed the final year medical students for the relevance of anatomy course. Whereas, others (Kaisen *et al*., 1984; Woodward & Ferrier, 1983) asked interns how well their medical curriculum prepared them for general medicine or post graduate training. However, this did not include a query on the relevance of anatomy as a basis for clinical years of undergraduate training and internships. In this study, both interns and final year medical students were asked 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 can be of help in a discussion on how to modify the anatomy curriculum. A comparison of such data between countries would have to take into account the differences in legislation, number of students, admission criteria etc., as had been partly summarized for Europe and the United States (Curtoni & Sutnick, 1995).

One striking fact to emerge from this investigation is that it clearly contradicts the current tendency of considering anatomy as a branch that can be neglected in modern medical curricula. A probable general outline has become apparent from this study, which would help medical faculties in designing the core anatomy curriculum without endangering and possibly even improving, the basic knowledge necessary for clinical practice.

Most of the participants felt that the different regions of gross anatomy taught were “adequate” but consider the amount of teaching on extremities as “too long and superfluous”. These findings are comparable with the findings of a survey of medical students at the end of undergraduate curriculum (Pabst, 1993; Pabst & Rothkötter, 1996).

About two-thirds felt that surface and living anatomy taught to them was “too short” and asked for more time in the curriculum. Other investigators (Monkhouse, 1992; Cahill & Carmichael, 1985; Metcalf & Metcalf 1983) have also argued in favour 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 (Moore & Dalley, 2006; Bowsher, 1976). Tavares and Silva (2002) reported that the sessions of living anatomy provide an indispensable background for most invasive procedures. Similarly, a sound knowledge of surface anatomy has always been necessary for accurate radiography, as most of the radiographic central points are based on surface anatomy (Mc Kears & Owen, 1979).

With the overall reduction in the time assigned for teaching anatomy to medical undergraduates (AACA, 1966; Whitteridge & Harris, 1962), the coverage of general anatomy seems to have suffered the most (Chaurasia, 1992). The present study also mirrors this opinion. In the present curriculum, 3 hours (table 1) are assigned for general anatomy, which were felt to be "too short". General anatomy lays down the foundation of the whole subject of medicine (Chaurasia, 1992). 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. One of the objectives of any clinical anatomy curriculum should be the development of a vocabulary in anatomical terminology. The feedback of this study shows that the consumer needs more emphasis on general anatomy in a reviewed curriculum.

Most of the interns and students felt that the amount of clinical and imaging anatomy they were taught was inadequate. Pabst (1993) in a survey also found an obvious need for more exposure on clinical anatomy for undergraduates. Majority of clinicians, too, feel that the current anatomical education of medical students is inadequate and below the minimum necessary for safe medical practice (Waterston & Stewart, 2005). They often blame anatomists for teaching the students too many details and not the clinically relevant structures (Pabst, 1993). Anatomists, on the other hand, face the well-known dilemma that at the time the students have to master large amounts of anatomical information, they are unaware of their application in clinical medicine. When the students are eventually ready to use the anatomical knowledge, a substantial part of the information has been forgotten (Arroyo-Jimenez *et al*., 2005). Clinical anatomy applies the structural aspects of human biology to better understand the function and dysfunction of the human body. Proficiency in clinical anatomy requires an understanding of the anatomy of the entire human body and the ability to apply such knowledge to solve clinical problems (AACA, 1996). There is wide spread support among clinicians for a more vertical integration of anatomy teaching throughout the undergraduate curriculum (Waterston & Stewart, 2005). The results of this survey also support a more clinically oriented anatomy in undergraduate curriculum.

A noteworthy observation was that more than half of the interns and students judged that imaging anatomy being taught was "too short". Imaging anatomy forms an important part of learning material (Arroyo-Jimenez *et al*., 2005). It is uncontested that sophisticated clinical imaging is an essential pathway to the precise study of structure and how it is maintained (Reidenberg & Laitman, 2002).

Through the study of imaging anatomy, the medical student is able to use information learnt 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), 3D visualization, multiaxial computerized image reconstruction and multiplaner magnetic resonance imaging (MRI) (Reidenberg & Laitman, 2002).

The interns and students felt the need for more PBL and case studies, considering them a valuable learning tool. Tavares and Silva (2001) documented that students attached a particular importance to the case studies. The case studies and/or case based teaching may not be introduced as a problem–based curriculum, as they have been by Dinsmore *et al*. (1993), but rather as representing a compromise between a traditional non-dissecting educational approach and the introduction of imaging, sectional and living anatomy as by Tavares and Silva (2001). The introduction of case based teaching and more PBL sessions motivate the students to acquire self-directed learning skills (Peplow, 1990).

The topographic anatomy of the Head & Neck region and Neuroanatomy are taught in the 2nd year, whereas their developmental

anatomy is taught in the 1st year. Students pointed out the difficulty they faced in comprehending the development of the head & neck and the nervous system because of the gap between topographic anatomy and developmental anatomy of these courses. About two thirds voted for 2nd year and about one fourth asked for review lectures in 2nd year. We believe that students will benefit more once they know the gross anatomy of the Head & Neck region and Neuroanatomy.

Pabst and Rothkötter (1996) have reported that residents ranked microscopic anatomy as necessary. Most of the respondents were satisfied with microscopic and developmental anatomy they were being taught but a considerable percentage felt it "too short".

Conclusions

The evaluation of a medical curriculum should be a multistep procedure: the students should both be examined and asked to complete questionnaires after different phases of the curriculum as well as at its end, to retrospectively define the relevance of the courses, as documented in this survey. We suggest that residents at the end of their residency and clinicians should also be asked to evaluate the undergraduate anatomy curriculum.

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

Adding more living and clinical anatomy to the new anatomy curriculum will motivate the students. Addition of a seminar on living anatomy with the presentation of patients and/or videos on common clinical problems in each region may make anatomy more relevant. This will also motivate the students to learn a multitude of facts 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. Classical dissection can also be enhanced by using ultrasound (US), 3D visualization, multiaxial computerized image reconstruction and MRI. This requires an interdisciplinary approach with surgeons, physicians and core anatomy faculty. We suggest that residents at the end of their residency and clinicians should also be asked to evaluate the undergraduate anatomy curriculum.

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