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Medical students' perception on anatomy knowledge relevance and retention during clerkship

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ABSTRACT

Introduction: Sufficient knowledge of anatomy is crucial for safe and efficient clinical practice. The majority of students in the traditional, non-problem based learning curricula found anatomy taught to them in the preclinical phase irrelevant to their clinical practice. **Aim:** This is a cross-sectional study aiming to investigate senior medical students' perception on anatomy taught in our hybrid problem based learning curriculum, and to measure anatomy knowledge retention during clerkship. **Methods:** A self-administered questionnaire and 10 validated multiple choice questions were used. 131 students from the 5th year and 6th years were included. **Results:** Around half of the students in each cohort appreciate the importance of knowing detailed contents of anatomy subject for the effective treatment of most medical problems. Two thirds believe that knowledge of anatomy is the most important to be a good physician, and its application to clinical practice should be reinforced early in medical education. However, two thirds have reported that anatomy knowledge fades away by the time they reach the clinical phase. This was supported by the results of the anatomy exam questions where the mean of the grades was 3.81 and 3.15 out of 10 among the 5th year and 6th years respectively. There was no significant difference between the two cohorts ($P > 0.05$), however, grades of female students were significantly higher ($P < 0.05$). **Conclusion:** Senior medical students appreciate the importance and relevance of anatomy knowledge received in our hybrid problem based learning curriculum to their clinical practice. However, there is considerable loss in anatomy knowledge during clerkship. We recommend vertical integration of anatomy from the first year through the clerkship and into specialist training, to improve clinically relevant anatomical knowledge retention. Tailored anatomy courses which are relevant to different specialties, could be conducted during clerkship to enhance more integration between basic and clinical fields.

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INTRODUCTION

Medical students, usually, spend at least their first 2 years in the college of medicine studying basic sciences before being involved in their clinical clerkship. However, an important question of medical education is what are the students learning, and to which extent the information is retained in their memory [1]. In response to this enquiry, several medical schools had begun to modify their preclinical curricula of basic medical sciences in order to demonstrate their relevance to clinical practice, to promote active student learning, and to improve knowledge retention [2]. However, studies had reported considerable knowledge loss among medical students regarding the basic sciences courses taught in the preclinical years. This may be attributed to the misconception of the

students that these basic medical sciences are "peripheral" to the medical profession and may be irrelevant to their clinical practice [3-5].

Anatomy, as one of the basic medical sciences, is believed to play a dynamic role in diagnostic reasoning and therapy in most specialties. Areas in clinical practice and patient management may vary regarding its direct relevance to anatomy; however, certain areas like imaging and physical examination were ranked by variety of clinicians as highly relying on anatomical knowledge [6-8]. It is generally perceived that sufficient knowledge of applied anatomy is crucial for safe and efficient clinical practice and ensures development and retention of clinical knowledge and skills [2,9]. The increasing trend of litigation for alleged

surgical malpractice has been suggested in part to be due to “anatomical ignorance” [10].

In Saudi Arabia, the majority of medical schools are planning to shift from traditional curricula to more innovative ones; almost all new medical colleges in the kingdom of Saudi Arabia are adopting the hybrid problem-based learning (PBL) curricula [11,12]. Saudi Arabia and other Gulf States’ universities in Gulf Corporation regions aimed at reforming their medical curricula based on the outcome of different studies investigating curricular diseases, in addition to students’ feedback on basic medical sciences [4,13,14]. Results of some national studies demonstrated that the majority of students found anatomy taught in the traditional, non PBL curricula was irrelevant to their clinical practice, and most of them are unable to recall information taught during the preclinical phase [4,5]. However, there is a conception among some basic and clinical teachers that PBL might have a negative effect on the knowledge base of the students [15].

Our curriculum at Faculty of Medicine, King Fahad Medical City is a hybrid PBL curriculum divided into three phases that are extended through 6 years. Phase one (premedical) is covered in year 1; Phase two (preclinical) is covered in year 2,3, and first semester of year 4; Phase three (clerkship) is covered up to the 6th year. Anatomy is taught in the preclinical phase as an integrated part of PBL. Some of it is taught within the context of the clinical cases and the other part as didactic lectures and practical sessions. Teaching of basic medical sciences, including anatomy, in our faculty, takes place during the preclinical phase and stops abruptly at the middle of year 4. In the clinical phase, students have no exposure to any structured basic science teaching.

We realize the importance of students’ feedback as we follow a student-centered approach to medical education; accordingly, our students are encouraged to be more involved in the evaluation and providing feedback on their curriculum. Unlike previous work that was conducted on traditional curricula, the aim of our study is to investigate senior students’ perception on anatomy taught during the preclinical years in our hybrid PBL curriculum, and its relevance to their clinical practice. In addition, we aim to evaluate anatomy knowledge retention during clerkship. The hypotheses that we tested were: First that students who were taught anatomy within the hybrid PBL curriculum are positive in their attitude toward the importance and clinical relevance of anatomy; secondly that there is a considerable degree of anatomy knowledge loss as students’ progress during their clerkship.

METHODS

Setting

The study was conducted at Faculty of Medicine, King Fahad Medical City Hospitals, King Saud Bin Abdulaziz University for health sciences Riyadh/KSA.

Ethical Approval

Ethical approval was obtained from Institutional Review Board-IRB at King Fahad Medical City (IRB Number: 13-083).

Subjects

This cross-sectional study included medical students from two cohorts (5th and 6th years) during the academic year 2012-2013.

Data Collection

Data were collected using a self-administered questionnaire which was inspired from literature available as evidence-based medical education research [16]. The questionnaire was pilot tested. Students’ participation was voluntary and anonymous and formal consent was obtained before being enrolled in the study. The questionnaire included closed-end questions aimed to obtain demographic data, type of rotation and nine questions investigating students’ perception toward anatomy taught in the preclinical phase, and its relevance to their clinical performance during the clerkship. Answers for these nine items were read on a five-point Likert scale as follows: Strongly agree, agree, neutral, disagree, and strongly disagree. In addition, we included 10 validated multiple-choice questions addressing different systems and regions of the body, which were covered during the preclinical phase, to test knowledge retention during clerkship. Time allowed to answer the questions was 10 min and it was answered in a setting similar to exam settings (appendix).

The students were aware that the grades of these questions will not affect their grade-point-average.

Data Analysis

Data were analyzed using the SPSS statistical software version 16 (Chicago, IL, USA). Simple descriptive statistics, *t*-test, and Pearson Chi-square analysis were used for data analysis. The degree of statistical significance is denoted by the *P* = 0.05.

RESULTS

Out of total 175 invited students, 131 accepted to take part in this study and 44 refused. This makes the overall response rate of 74.6%. The 131 students enrolled in the study consisted of 54 (41.2%) female and 77 (58.8%) male students. The population under study was coming from two cohorts, the 5th year and the 6th year medical students. Table 1 demonstrates more descriptive characteristics of the study population.

5th year students (58) enrolled in this study were distributed in the following rotations: General surgery (24), family medicine (22), pediatrics (11), and internal medicine (1). 6th year students (73) were distributed in rotations as follows: Internal medicine (19), orthopedic (19), neurology (18), obstetrics and gynecology (10), general surgery (3), pediatrics (2), cardiology (1), and psychiatry (1).

To better understand and analyze students' perception on anatomy curriculum taught in the preclinical years and its relevance to their medical practice, we considered results analysis of the two cohorts separately and this allowed us to compare between the two groups with regard to all questions. Table 2 demonstrates the perception of students in the two cohorts. Around half of the students in each cohort appreciate the importance of knowing detailed contents of anatomy subject in the effective treatment of most medical problems. In addition, around two-thirds of the students in each cohort agree and strongly agree that knowledge of anatomy is the most important to be a good physician, and that the application of this knowledge to clinical practice should be reinforced early in medical education.

Considering knowledge and experience in anatomy in the preclinical phase, around 68% of the students in each cohort agree and strongly agree that it is fundamental to their future role as physicians. However, similar percentages of students in each cohort have reported that anatomy knowledge fades away by the time students reach the clinical phase. Out of nine questions asked to evaluate students' perception, there was a significant difference in students' perception between the two cohorts for only one question about how students feel themselves being less well prepared in anatomy that they have received in their hybrid PBL curriculum ($P < 0.05$). 6th year students rated significantly higher than those in 5th year.

We calculated the grades of the students for the anatomy questions out of 10 [Table 3]. There was no significant difference between the grades of the two cohorts ($P > 0.05$). However, we detected a significant difference in the grades between male and female students, being significantly higher for females ($P = 0.000$).

DISCUSSION

It was always believed that anatomy is the cornerstone of medical education and that it provides a platform of knowledge that is essential for all medical careers [17]. Our results showed that most of our students during their clerkship appreciate the importance of studying anatomy for being a good physician. This is consistent with the findings of other studies, which demonstrated that senior medical students, compared to junior students, appreciate more the importance of the basic sciences courses taught in the preclinical years and its relevance to clinical medicine [6,16]. The diversity of the clinical rotations in which our students were enrolled reflects their perception towards the relevance of anatomy to different clinical specialties.

Table 1: Descriptive statistics of the study population

	5 th year students (%)	6 th year students (%)	Total (%)
Gender			
Female	21 (38.9)	33 (61.1)	54 (100)
Male	37 (48.1)	40 (51.9)	77 (100)
Total students	58 (44.3)	73 (55.7)	131 (100)
Age*	23.1 (± 1.1)	23.88 (± 1.2)	

*Mean (\pm SD), SD: Standard deviation

The vast majority of our students in the two cohorts believe that teaching anatomy in an integrated manner to be correlated with the clinical practice is an important skill which should be reinforced early in medical education. This concept is applied to PBL environment where basic science is learnt in the context of clinical problems [18]. On the contrary, senior students in non-PBL curricula believe that the basic medical courses including anatomy were not relevant to their clinical practice [4,5].

In the present study, 36% and 57% of students in the 5th and 6th years respectively believed that they are less well prepared in anatomy knowledge received within their hybrid PBL curriculum. This perception is consistent with the findings of Dochy *et al.* (2003) who reported that the basic knowledge gained could be less within students who follow PBL compared with their colleagues in traditional curricula [15]. On the other hand, the results of Prince *et al.* (2003) demonstrated that there was no significant difference in the anatomy test scores between PBL and non-PBL students. These perceived deficiencies among PBL students, including ours, may be attributed to the gap between what students actually know and what they believe that they should know [19]. In addition, students may feel that the studied health problems in a PBL curriculum did not necessarily cover all the knowledge supposed to be covered during the preclinical phase [20].

In our study, the grades of the two cohorts in the anatomy questions show a considerable knowledge loss among senior medical students during their clerkship. The mean of the grades was 3.81 and 3.15 out of 10 for the 5th and 6th years, respectively. There was no significant difference between the two cohorts ($P = 0.055$). The lower scores of the 6th year students might be an indicator for the greater knowledge loss among senior students as they proceed in their clinical years and becoming more detached from the basic medical sciences. This detectable knowledge loss was consistent with the perceived one as shown by students' response to the 8th item in our questionnaire. More than 60% of students either agreed or strongly agreed that their anatomy knowledge fades by the time they reach the clerkship. This reflects the conscious realization of our senior students regarding this problem. These findings are consistent with those of previous studies, which had reported significant knowledge loss and difficulty in retention of anatomy and basic sciences knowledge taught during the preclinical phase [4,5,14,21]. Knowledge loss could be attributed to many reasons including volume overload, teaching methods, lack of clinical application, insufficient time allocated for teaching the subject, in addition to lack of knowledge reinforcement over time [4,5,22]. Such a problem could be managed through revisiting the important relevant anatomical concepts through a structured clinical anatomy course during clerkship; this could bridge the gap between preclinical and the clinical phases [23-26].

There was a significant difference in the grades of the anatomy questions between male and female students, being better in females. This finding is congruent with the results of a previous study that was conducted by Al-Mously *et al.* (2013) at our

Table 2: Students' perception on relevance of anatomy curriculum taught in the preclinical years to medical practice

	5 th year <i>n</i> =58 (44.3%)	6 th year <i>n</i> =73 (55.7%)	<i>P</i> value
A physician can effectively treat most medical problems without knowing the details of the anatomy of the system involved			0.297
Strongly agree	5 (8.6)	7 (9.6)	
Agree	13 (22.4)	19 (26.0)	
Neutral	7 (21.1)	12 (16.4)	
Disagree	16 (27.6)	25 (34.2)	
Strongly disagree	17 (29.3)	10 (13.7)	
Knowledge of anatomy is the most important for a good physician			0.094
Strongly agree	22 (37.9)	16 (21.9)	
Agree	26 (44.8)	33 (45.2)	
Neutral	6 (10.3)	19 (26.0)	
Disagree	4 (6.9)	4 (5.5)	
Strongly disagree	0 (0.0)	1 (1.4)	
Applying anatomy knowledge to clinical practice is a skill which should be reinforced early in medical education			0.245
Strongly agree	26 (44.8)	21 (28.8)	
Agree	23 (39.7)	42 (57.5)	
Neutral	8 (13.8)	8 (11.0)	
Disagree	1 (1.7)	1 (1.4)	
Strongly disagree	0 (0.0)	1 (1.4)	
With anatomy, It is first necessary to learn as many facts as possible and then learn to apply them in the clinical skills			0.359
Strongly agree	15 (25.9)	18 (24.7)	
Agree	29 (50.0)	37 (50.7)	
Neutral	8 (13.8)	14 (19.2)	
Disagree	3 (5.2)	4 (5.5)	
Strongly disagree	3 (5.2)	0 (0.0)	
Student should learn only general concepts in anatomy (rather than small details) in order to be a competent physician			0.208
Strongly agree	6 (10.3)	16 (21.9)	
Agree	19 (32.8)	28 (38.4)	
Neutral	13 (22.4)	15 (20.5)	
Disagree	15 (25.9)	11 (15.1)	
Strongly disagree	5 (8.6)	3 (4.1)	
During the preclinical phase, staff members used to stimulate students' curiosity through the teaching of anatomy			0.720
Strongly agree	10 (17.2)	14 (19.2)	
Agree	29 (50.0)	28 (38.4)	
Neutral	13 (22.4)	22 (30.1)	
Disagree	4 (6.9)	5 (6.8)	
Strongly disagree	2 (3.4)	4 (5.5)	
The information and experiences I have received to date in anatomy are fundamental to my future role as a physician			0.262
Strongly agree	7 (21.1)	19 (26.0)	
Agree	27 (46.6)	31 (42.5)	
Neutral	16 (27.6)	16 (21.9)	
Disagree	5 (8.6)	6 (8.2)	
Strongly disagree	3 (5.2)	1 (1.4)	
Anatomy knowledge from preclinical years fades by the time I reach clinical clerkship			0.829
Strongly agree	13 (22.4)	20 (27.4)	
Agree	24 (41.4)	31 (42.5)	
Neutral	15 (25.9)	17 (23.3)	
Disagree	6 (10.3)	5 (6.8)	
Strongly disagree	0 (0.0)	0 (0.0)	
I find myself less well prepared in anatomy which I had received through PBL curriculum			0.018
Strongly agree	11 (19.0)	19 (26.0)	
Agree	10 (17.2)	23 (31.5)	
Neutral	20 (34.5)	15 (20.5)	
Disagree	12 (20.7)	16 (21.9)	
Strongly disagree	5 (8.6)	0 (0.0)	

PBL: Problem based learning

medical school showing superior academic performance of female students in pre-clinical courses [27]. This could explain the better retention of basic knowledge among our female students during the clinical phase.

There are certain limitations in our study including the relatively small sample size which is attributed to the limited number of students admitted to our school. Furthermore, the few number of anatomy questions that may cover a narrow range of anatomy

Table 3: Test grades difference according to academic year and gender (Grades are out of 10)

	Mean (\pm SD)	P value
Academic level		0.055
5 th year	3.81 (\pm 1.9)	
6 th year	3.15 (\pm 2.0)	
Gender		0.000
Female	4.17 (\pm 1.9)	
Male	2.94 (\pm 1.9)	

SD: Standard deviation

knowledge. In addition, we consider another limitation, which is the sixth item in the questionnaire asking about the anatomy staff members' attitude during the preclinical phase; actually, this is considered as feedback which ideally should be fresh; however, we included this question as we believe that teaching methods play an important role in students' satisfaction regarding subject contents and delivery.

Further research is required to help educators to identify and consequently manage the different factors leading to knowledge loss during medical education.

CONCLUSION

Results of our study demonstrated that senior medical students appreciate the importance and relevance of anatomy knowledge received in our hybrid PBL curriculum to their clinical practice. However, it also demonstrated considerable loss in anatomy knowledge during clerkship that could affect negatively the clinical competencies of the future physicians; this was evident from students' responses and grades of the anatomy exam. We believe that our findings could be a step toward reforming anatomy curriculum in our medical school. We recommend vertical integration of anatomy into our curriculum from the 1st year through the clerkship and into specialist training, to improve clinically relevant anatomical knowledge retention. In addition, tailored anatomy courses which are relevant to different specialties, could be conducted during clerkship to enhance more integration between basic and clinical fields.

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