

RESEARCH ARTICLE

Evaluation of Clinical Anatomy Knowledge Levels of Medical Students According to Years

Tıp Fakültesi Öğrencilerinin Klinik Anatomi Bilgi Düzeylerinin Yıllara Göre Değerlendirilmesi

Feyza AKSU^{1,a}, Ramazan Fazıl AKKOÇ¹, Onur ARAS², Ayşe BİÇER¹, Ahmet KAVAKLI¹

¹Fırat Üniversitesi Tıp Fakültesi, Anatomi Anabilim Dalı, Elazığ, Türkiye

²Gazi Üniversitesi Tıp Fakültesi, Anatomi Anabilim Dalı, Ankara, Türkiye

F.A. 0000-0001-8595-0010, R.F.A. 0000-0002-0559-8932, O.A. 0000-0001-9862-6316,

A.B. 0009-0009-9548-6413, A.K. 0000-0003-0754-8901.

^aCorresponding Author: Feyza AKSU (feyz-aksu@hotmail.com)

ABSTRACT

Objective: Clinical anatomy is taught in the first two years of Fırat University Medical Faculty, in anatomy lessons sometimes as a separate course hour and sometimes within the relevant course hour. This study aimed to evaluate how long clinical anatomy knowledge is retained in students and whether there is a change in this retention in students who move on to the clinical internships.

Material and Method: Ten multiple-choice questions, covering clinical knowledge taught by the faculty members of the Anatomy Department, were administered to students. The study was conducted on a voluntary basis, excluding first and sixth year students, at Fırat University Faculty of Medicine.

Results: The study included 489 students (term 2-150, term 3-123, term 4-110, term 5-106). Of the participants, 252(51.5%) were female, and 237(48.5%) were male. Analysis of the answers revealed that the second year students achieved the highest number of correct responses, with an average of 7 out of 10 questions answered correctly. Year-based evaluation of the overall question set showed the second year students achieving the highest correct answer rate at 90.9%.

Conclusion: It was observed that anatomy knowledge acquired during the first and second years was often forgotten, even when reinforced through clinical rotations. We believe that increasing the number of clinical anatomy courses in the curriculum and incorporating them into additional years through both horizontal and vertical integration is essential for improving the retention of anatomy knowledge. Furthermore, transitioning from traditional anatomy education to innovative teaching models could significantly enhance knowledge retention.

Keywords: Anatomy Education, Medical Education, Clinical Anatomy.

ÖZET

Amaç: Fırat Üniversitesi Tıp Fakültesi'nde ilk iki yılda klinik anatomi, anatomi derslerinde bazen ayrı ders saati olarak bazen de ilgili ders saati içinde anlatılmaktadır. Bu çalışmada; klinik anatomi bilgilerinin öğrencide ne kadar kalıcı olduğunun, klinik döneme geçen öğrencilerde bu kalıcılıkta bir değişiklik olup olmadığının değerlendirilmesi amaçlandı.

Gereç ve Yöntem: Anatomi Anabilim Dalı Öğretim Üyeleri tarafından anlatılan konularla ilişkili klinik bilgilere yönelik çoktan seçmeli 10 soru öğrencilere uygulandı. Çalışma gönüllülük esası gözetilerek Fırat Üniversitesi Tıp Fakültesi'nde dönem 1 ve 6 öğrencileri hariç diğer öğrenciler ile yapıldı.

Bulgular: Çalışmaya 489 (dönem 2-150, dönem 3-123, dönem 4-110, dönem 5-106) gönüllü öğrenci dahil edildi. Katılımcıların 252 (% 51.5)'si kadın, 237 (% 48.5)'si erkekti. Yanıtlar incelendiğinde, 10 soru içinde sayıca en fazla doğru cevap alınan dönem, 7 soru ile dönem 2'dir. Soruların toplamında dönem bazlı değerlendirme yapıldığında en fazla yüzde ile doğru cevap dönem 2'de (%90.9) verilmiştir.

Sonuç: Dönem 1 ve 2'de öğrenilen anatomi bilgilerinin, klinik stajlarda desteklenmesine rağmen unutulduğu görüldü. Anatomi bilgilerinin kalıcılığı için, müfredatta yer alan klinik anatomi derslerinin artırılmasının ve diğer dönemlerde hem yatay hem de dikey entegrasyonla yer verilmesinin anatomi bilgilerinde kalıcılık için

gerektiği kanaatindeyiz. Dahası anatomide klasik eğitimden çıkılıp farklı eğitim modellerine geçişin bilgide kalıcılığı arttıracak düşüncesindeyiz.

Anahtar Sözcükler: Anatomi Eğitimi, Tıp Eğitimi, Klinik Anatomi.

The primary goal of education in medical faculties, which are integral to higher education institutions, is to teach medical knowledge, equip students with the manual skills of medicine, and ensure that these skills and knowledge are applied in alignment with professional ethical values (1). In order for medical education to train good physicians, it is accepted that an education method based on active participation, practical applications and learning by doing should be used (2).

In Turkey, medical education spans six years, comprising two main phases: basic medical education and applied clinical education. Anatomy, a cornerstone of medical education, studies the structure and organization of the human body, the organs it comprises, and their spatial relationships (3, 4). The teaching and learning of anatomy, which is considered as the compulsory "language of medicine", has faced numerous challenges, including curriculum updates, instructor shortages, limited cadavers for dissection, growing demands for medical techniques like radiology and endoscopy. There are also concerns about the increasing number of medical students and other constraints as well as the search for effective use of new technologies in anatomy education. (5). Anatomy education guides students in their initial foray into the medical field and shapes their professional identity. It is also known that cadaver dissection training has a significant impact on the career paths of students, as those who receive cadaver dissection training are more likely to specialise in surgery, which is a fundamental area of medical practice (6). A thorough understanding of anatomy is crucial for safe clinical practices, especially in surgical fields. Teaching human anatomy, like any other subject, requires regular updates to identify the most effective instructional tools and methods (7). For example, the recent outbreak of the Covid-19 pandemic has demonstrated the need for a rapid transition to online learning in an emergency situation, requiring many learning and teaching approaches in anatomy to be rethought and adapted for the online context (8, 9).

Every physician must have a robust knowledge of anatomy. Having a good knowledge of anatomy provides a better understanding of the function and functionality of the structures. In order to be able to distinguish the pathological in the clinic, it is essential to learn the science of anatomy, which describes the nature of the structure. Recently, integration anatomy education with clinical information and radiological images has enhanced students' understanding. In addition, this integration is becoming

increasingly important because it provides students with an idea of what they may encounter in the future. For years, the necessity and importance of radiological and clinical anatomy courses in medical education and the appropriate periods in which these courses should be given have been discussed (10-12).

The aim of this study is to evaluate the retention of clinical anatomy knowledge, which is taught either within the anatomy course or as a separate subject during the first and second years of medical education, and to assess whether there is any change in this retention among students who have transitioned to the clinical phase.

MATERIAL AND METHOD

This descriptive study included second, third, fourth, and fifth year medical students from Fırat University Faculty of Medicine on a voluntary basis. Ethical approval was obtained from the Fırat University Non-Interventional Research Ethics Committee (2024/01-15). Participants answered ten multiple choice questions designed to assess knowledge of clinical anatomy based on topics taught in Anatomy courses. The questionnaire was administered online. In order to ensure the reliability of the responses, personal information such as participants' names, surnames, and phone numbers was not collected.

Statistical Analysis

Data were analyzed using IBM SPSS 27. Quantitative variables were expressed as mean $\pm$ standard deviation, while qualitative variables were reported as frequency and percentage (n(%)). Pearson and Fisher's exact chi-square tests were used to compare qualitative variables, and Kappa correlation coefficients were calculated to assess relationships. The significance level was set at 0.05.

RESULTS

Of the 489 students who participated voluntarily, 30.7% (n =150) were second year, 25.1% (n =123) were third year, 22.5% (n =110) were fourth year and 21.7% (n =106) were fifth year students. The group consisted of 51.5% (n =252) female and 48.5% (n =237) male students, and the mean age was 22.00 ± 1.64 years (range: 19-30).

The responses of 489 students to the 10 questions in the questionnaire are given in Table 1.

Table 1. Correct and incorrect answers to the questions (n (%)).

	Correct answer n (%)	Wrong answer n (%)	Total response n (%)
Which artery is used to palpate the pulse on the anterior side of the wrist?	479 (%98)	10 (%2)	489 (%100)
What is the name of the region where breathing sounds can be heard most clearly?	473 (%96.7)	16 (%3.3)	489 (%100)
Which nerve function is checked during the carpal tunnel examination?	411 (%84)	78 (%16)	489 (%100)
In the standard blood pressure measurement method, over which artery is the stethoscope diaphragm placed?	475 (%97.1)	14 (%2.9)	489 (%100)
Which muscle is examined in torticollis?	407 (%83.2)	82 (%16.8)	489 (%100)
Which vertebra's spinous process is the first to be palpated externally during a spinal examination?	317 (%64.8)	172 (%35.2)	489 (%100)
In case of foreign body aspiration, which lung is the object most likely to enter?	436 (%89.2)	53 (%10.8)	489 (%100)
In an abdomen divided into four quadrants, which quadrant is examined for appendicitis?	466 (%95.3)	23 (%4.7)	489 (%100)
Where does the pain radiate/reflect in pancreatic diseases?	427 (%87.3)	62 (%12.7)	489 (%100)
In kidney-related diseases, particularly during stone passage, where is the examination performed?	344 (%70.3)	145 (%29.7)	489 (%100)

The correct response rates for all questions combined were highest in second year students (90.9%), followed by fourth year (86.5%), fifth year (85.4%), and third year (82.4%) (Table 2).

Table 2. Distribution of correct and incorrect answers according to years.

	2. Year n (%)	3. Year n (%)	4. Year n (%)	5. Year n (%)
Right Answers	1364 (%90.9)	1013 (%82.4)	952 (%86.5)	906 (%85.4)
Wrong Answers	136 (%9.1)	217 (%17.6)	148 (%13.5)	154 (%14.6)
Total Answers	1500	1230	1100	1060

Analysis of individual questions revealed that second year students had the highest correct answer rate for 7 out of 10 questions, while fifth year students had the highest correct answer rate for the other 3 questions.

The analysis revealed that the correct answer rates decreased and the incorrect answer rates increased in the third and fourth years when anatomy courses were not given. Although there was a decline in the correct answer rates in the fifth year compared to the second year on a question-by-question basis, an improvement was observed compared to the other years. (Table 3).

Table 3. Response rates of each question according to periods.

	2. Year		3. Year		4. Year		5. Year		p
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong	
Which artery is used to palpate the pulse on the anterior side of the wrist?	148 (%98.7)	2 (%1.3)	118 (%96)	5 (%4)	107 (%97.3)	3 (%2.7)	106 (%100)	0 (%0)	0.148
What is the name of the region where breathing sounds can be heard most clearly?	149* (%99.3)	1 (%0.7)	120 (%97.6)	3 (%2.4)	101 (%91.8)	9 (%8.2)	103 (%97.2)	3 (%2.8)	0.008
Which nerve function is checked during the carpal tunnel examination?	125 (%83.3)	25 (%16.7)	99 (%80.5)	24 (%19.5)	94 (%85.5)	16 (%14.5)	93 (%87.7)	13 (%12.3)	0.387
In the standard blood pressure measurement method, over which artery is the stethoscope diaphragm placed?	148 (%98.7)	2 (%1.3)	117 (%95.1)	6 (%4.9)	106 (%96.4)	4 (%3.6)	104 (%98.1)	2 (%1.9)	0.301
Which muscle is examined in torticollis?	123 (%82)	27 (%18)	89 (%72.4)	34 (%27.6)	99 (%90)	11 (%10)	96* (%90.6)	10 (%9.4)	0.000
Which vertebra's spinous process is the first to be palpated externally during a spinal examination?	119* (%79.3)	31 (%20.7)	79 (%64.2)	44 (%35.8)	53 (%48.2)	57 (%51.8)	66 (%62.3)	40 (%37.7)	0.000
In case of foreign body aspiration, which lung is the object most likely to enter?	136 (%90.7)	14 (%9.3)	110 (%89.4)	13 (%10.6)	97 (%88.2)	13 (%11.8)	93 (%87.7)	13 (%12.3)	0.863
In an abdomen divided into four quadrants, which quadrant is examined for appendicitis?	149* (%99.3)	1 (%0.7)	106 (%86.2)	17 (%13.8)	109 (%99.1)	1 (%0.9)	102 (%96.2)	4 (%3.8)	0.000
Where does the pain radiate/reflect in pancreatic diseases?	141* (%94)	9 (%6)	96 (%78)	27 (%22)	100 (%90.9)	10 (%9.1)	90 (%84.9)	16 (%15.1)	0.002
In kidney-related diseases, particularly during stone passage, where is the examination performed?	126* (%84)	24 (%16)	79 (%64.2)	44 (%35.8)	86 (%78.2)	24 (%21.8)	53 (%50)	53 (%50)	0.000

*There is a statistical significance between the year with the highest correct answers to the related question and the year with the lowest correct answers, $p < 0.05$.

DISCUSSION

Numerous studies highlight that anatomy forms the foundation of medical education. Anatomy, which has a strong visual aspect, is a course with low retention after learning. Retention of anatomy knowledge is critical for understanding clinical conditions, which is why traditional anatomy education is increasingly supported with clinical and radiological images (4, 10, 13, 14).

In this study the students were asked questions based on fundamental anatomical knowledge that was covered during anatomy course hours, not overly detailed, and frequently needed to be applied in clinical practice. These questions assessed how long students retained clinical anatomy knowledge and whether this retention changed as they transitioned to the clinical phase of their education.

In a study on anatomy education, it was reported that after intensive and effective instruction of anatomy courses in the early years of medical education, detailed anatomy related to specific departments is not adequately covered during the internship or residency periods, thereby creating a need for such instruction (14). Upon reviewing the results of this study, it was found that seven questions were most frequently answered correctly by second year students, while three were most frequently answered correctly by fifth year students. In addition to aligning with findings in the literature, the study's use of questions that directly integrate basic anatomical knowledge with clinical applications enhances the objectivity of the data.

Previous studies have reported that teaching anatomy without connecting it to clinical practice allows students to rely on rote memorization for learning, resulting in superficial understanding and minimal effort. This approach, however, may leave students inadequately prepared in the fundamental competencies expected by the end of medical education, potentially impacting public health (15, 16). Although the questions in this study were clinically related, they primarily focused on anatomy. Overall, the highest percentage of correct answers was observed in the second year (90.9%), when clinical anatomy courses were taken. This rate dropped significantly in subsequent years, particularly in the third year (82.4%). These findings suggest that learning is achieved at a high level during the period when clinical anatomy courses are actively taught. However, as students transition to clinical internships, where basic and clinical anatomy are not actively reinforced, the foundational knowledge gradually diminishes. Consequently, without revisiting anatomy that describes normal structures, the understanding of pathological conditions does not become well established.

According to the study data, the highest number of correctly answered questions was seven in the se-

cond year and three in the fifth year. However, when considering the answers to all ten questions in total, the highest percentage of correct responses occurred in the second year (90.9%). This rate was lowest in the third year, and in the fourth and fifth years, it remained lower than in the second year. We believe this drop can be attributed to the lack of emphasis on basic anatomy in the third year. Other studies in the literature have reported that periodic repetition of information is a key factor in enhancing knowledge retention and overall educational outcomes (17). In this context, the findings of our study align with the literature.

In the study conducted by Akkoç et al. (14), it was reported from a clinician's perspective that anatomy courses should not be confined to the first two years but should also be incorporated into later years, and that department-based anatomy education should be included during the residency training. In our study, the correct answer rate was low in all years, except for the second year, in which clinical anatomy courses were taught. These results suggest that the retention of anatomy knowledge taught in the second year gradually decreases in subsequent years. To enhance the retention of this information, we believe that clinical anatomy courses, in addition to basic anatomy, should be emphasized in years beyond the first two, or that department-based anatomy should be taught and reinforced by department instructors in a clinically relevant manner during clinical internships. We also believe that implementing innovative educational methods, rather than relying solely on traditional teaching approaches, could improve retention in anatomy courses.

When considering the study questions individually, the three questions with the highest correct answer rates correspond to topics covered in both theoretical and practical courses, which were repeated multiple times and emphasized for their importance. When reviewing other studies in the literature, one study evaluating student preferences for online versus in-person education during the pandemic reported that students preferred all practical courses to be conducted in person. This feedback underscores the significance of practical courses for professional development and knowledge retention (9). In another study on qualifications, it was found that continuous, practical training at regular intervals is the most important factor influencing knowledge retention (17). In this regard, the findings of our study align with the literature.

Limitation of the Study

This study was limited to data collected from students at Fırat University Faculty of Medicine. Therefore, the data cannot be generalized for different universities. The survey was not conducted face-to-face, it was conducted online. Therefore, the number of volunteers participating in the study was below the number of students present.

Conclusion

Medical education is a long and demanding process that involves acquiring foundational knowledge and integrating it with concepts of disease, diagnosis, and treatment. Anatomy courses, which form the foundation of medicine, include clinical anatomy courses that enhance the learning of anatomical information. To ensure the retention of this knowledge, we believe clinical anatomy courses should not be confined to the first two years. Instead, anatomy or clinical anatomy courses should continue in the third year and even in the fourth and

fifth years, when practical clinical education is provided, to reinforce basic anatomical concepts. Furthermore, we believe that establishing communication and direct integration between clinical departments and basic medical departments, particularly the anatomy department, will boost student motivation and lead to a successful improvement in outcomes. Additionally, moving away from the traditional education model in anatomy and implementing alternative teaching approaches will likely enhance knowledge retention.

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