Relevance of Learning Anatomy to Clinical Practice: Perceptions of Medical Students, Interns, and Clinicians

Priyadharshini N. A.1 Dinesh Kumar V.2 Rajprasath R.3 Rema Devi3

1Department of Anatomy, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India
2Department of Anatomy, JIPMER, Puducherry, India
3Department of Anatomy, Pondicherry Institute of Medical Sciences, Puducherry, India

Address for correspondence Dr. Rajprasath R., MBBS, MD, Department of Anatomy, Pondicherry Institute of Medical Sciences, Puducherry-605014, India (e-mail: rajprasathanat@gmail.com).


Abstract

Introduction Anatomy is considered as the cornerstone of medical education and its teaching methodologies are undergoing metamorphosis. Anatomy education is often debated as over teaching of body facts and undertaught clinical facts by modern and traditional anatomy mentors respectively. Equilibrium between this episteme of anatomy education could be achieved after considering the perceptions of anatomy stakeholders. The present study was an initiative of the same.

Methodology A quantitative survey was administered among 60 medical students (4th semester), 60 interns, and 30 clinicians (both medical and surgical fields). The completed questionnaires were analyzed and the results were tabulated.

Results Though anatomy education is suffocating due to reduction in teaching hours, all the study groups have strongly agreed that cadaver contact is crucial for better understanding of the human body. The perception regarding the importance of anatomy education in clinical practice was statistically significant \(p = 0.04\) among the study groups. The insight of role of anatomy education in enabling lifelong self-directed learning and inculcating professional skills and ethics of medicine showed significant \(p\) value \(p = 0.00\) and 0.01.

Discussion The present study has echoed the perception of anatomy stakeholders. Studies emphasize that revamping of anatomy curricula is needed for the time and that can be made with the inputs from the academic anatomists and clinicians. Clinicians expressed the lag between anatomy teaching and clinical practice. Medical students felt that anatomy education kindled them to develop inquiry-based learning, helped to master radiological images, and improved their teamwork and communication skills.

Introduction Anatomy, despite being a cornerstone in undergraduate medical curriculum, often suffocates owing to reduction in time available for teaching it. This made some academicians to dread that, “the amount of detail in many courses of gross regional anatomy has now decreased below the safety level.”1 Modernists view the ubiquitous presence of technology as silver lining and proclaim that it enables students develop a deeper understanding of anatomical basis of diseases and problem-solving skills.2 Adding to the fire, The General Medical Council for the United Kingdom has issued guidelines to medical schools,3 stating that “undue emphasis on detail was not required” and called for a reduction in “factual information” within medical curricula.4,5 Triumph of anatomy learning would depend on achieving balance between the two. The path for that equilibrium is the question of the hour. The role of anatomy in clinical contexts is uncontested. Ironically, it was suggested that there is great difficulty in specifically transferring fundamental anatomical knowledge to clinical application. In one study by Woods et al,6 only 14% of final year students felt “confident in their
anatomical knowledge.” Also, as the students gain knowledge later and later in their clinical years, their mind-set about the role of anatomy may change.\textsuperscript{2} Schoeman and Chandratilake\textsuperscript{6} have introduced the term “anatomy competence” and define it as the possession of appropriate anatomy knowledge, and practical and clinical application of this knowledge.

Does the loss of teaching time in anatomy in particular matter if issues regarding clinical relevance are addressed? This fact has been strongly argued by both anatomists and surgeons.\textsuperscript{8} Two key perspectives often face a polemic tie in teaching anatomy: one perspective advocates the traditional approach, whereby the structures are taught in a region wise approach aided hugely by dissection and the other perspective favoring a clinically orientated learning whereby the elements are taught along with their relevance to clinical practice.\textsuperscript{10} The traditionalists argue that reduction in anatomy teaching, and the consequent decline in anatomical knowledge, is leading to an increase in claims of surgical negligence where the cause can be attributed to lack of anatomical understanding.\textsuperscript{11,12} On the other hand, the modernists argue that they witness significant resistance to new pedagogic innovations and incorporation of multimodal sources to deliver information would both address the issue of time by using it more effectively and also would more be in tune with the way the present generation students learn.\textsuperscript{13}

In a study of novice epistemologies,\textsuperscript{14} students viewed the anatomy discipline being substantially different to that of peer disciplines, such as physiology, largely owing to the huge set of facts codified in a specialized language embedded in it. In another study by Waterston and Stewart,\textsuperscript{15} clinicians felt that students leave medical education with inferior anatomical knowledge. Upon closer analysis, it could be made out that surgical specialists often feel that students require high levels of anatomical knowledge. Boshuizen et al\textsuperscript{16} described a gap between professional knowledge and academic knowledge, implying unfortunate parallelism and lack of connection between formal anatomy education and the clinical workplace. It might be due to the fact that the students were taught anatomy that was deemed irrelevant by the consultants.

On observing the above-mentioned arguments, we could sense that there is an apparent lack of consensus among the medical students and clinicians in establishing concretely what anatomy is clinically important and how much should be taught as part of medical curricula. The cardinal complicating factor in arriving at the consensus may, in part, be due to the broad spectrum of future specialties that medical students will later practice in, each of which presumably has a different anatomical focus and dependence.\textsuperscript{17} Our aim was to gather the opinions of clinicians, interns and 4th semester medical students, who have completed few clinical postings to provide an insight into what and how much anatomy that the medical graduates require to undertake successful clinical endeavors. We also aimed at gathering the views regarding the relevance of anatomy in each point of clinical decision making in their respective fields, from a wide array of clinicians (both surgical and nonsurgical). As the requirements of education and practice keep evolving, the definition of anatomical competence needs to be operationalized and reoperationalized. To accomplish this, we adopted a questionnaire-based cross-sectional survey that explores the differences in attitudes between clinicians in different specialities regarding the role of anatomy in the clinical setting and documents the perceptions of medical students on how far they can apply what they have learnt in first year within the clinical setting.

**Materials and Methodology**

The present study was a cross-sectional questionnaire-based design. After obtaining ethical approval from institute ethics committee (IEC- RC/17/56), the study was performed between November 2017 and may 2018 among 60 4th semester medical students who had completed one clinical posting and could give valued opinion, 60 interns and 30 clinicians of Pondicherry Institute of Medical Sciences, Pondicherry. All participants had anatomy classes during their first MBBS. Anatomy teaching consisted of totally 650 hours of teaching that includes didactic lecture (for gross anatomy, microscopic anatomy, embryology, osteology, and radiological anatomy), practical classes as dissection, small group teaching, and demonstration. All the medical students of 4th semester were of 19 years, interns were 23 to 24 years, and clinicians were in the broad group of 32 to 50 years of age. Sex-matched participants were there in each group. The study group was recruited voluntarily after getting written informed consent. A prevalidated questionnaire adopted from a study was administered to all the study groups.\textsuperscript{18} Participants in the study were summarized as frequencies and percentages. All the items of the questionnaire had a score ranged from 1 to 5, framed as per the five-point Likert scale. Item wise score on perceptions related to future clinical decision making was summarized as mean and standard error of mean. Difference in item score was tested either by student “t” test or Mann–Whitney “U” test based on the statistical distribution of data. Statistical significance was considered as p value of less than 0.05. Similarly, cumulative score of all the items was summarized as mean with standard error and the difference among different groups were tested using Student’s t-test. All the statistical analyses were done using EpiData analyser software version 2.2.2.178 (The EpiData Association, att. Jens Lauritsen, Enghavevej 34, DK5230 Odense M, Denmark, Europe) from http://www.epidata.dk/.

**Results**

Sixty 4th semester medical students, 60 interns, and 30 clinicians had completed the questionnaire. The results are tabulated as mean±standard error of mean (SEM) after statistical analysis. Seven questions were asked in common for all the study groups regarding general perceptions on the relevance of anatomy with a total score of 35 (maximum rating scale for each question is 5 = strongly agree). The mean perception score of all the three groups was 30.02 for 4th semester students, 29.2 for interns, and 28.1 for clinicians (\textsuperscript{\textbullet}Table 1).
The mean agreement ratings of 4th semester students, interns (Table 2) and clinicians (Table 3) on perceptions of relevance of anatomy in the medical curriculum are calculated as mean ± SEM. All three groups have strongly agreed to the fact that cadaver contact is very important in acquiring sufficient clinical knowledge and skills with mean score of 4.72 (4th semester), 4.68 (interns), and 4.83 (clinicians). Most of the participants strongly agreed that they have understood the importance of anatomy education.
in their clinical practice which was statistically significant ($p = 0.04$). When asked about the importance of anatomy education in making them a self-directed lifelong learner, majority have agreed to it with a mean score of 4.47 (4th semester), 4.37 (interns), and 3.33 (clinicians). The mean perception score of importance of anatomy in understanding the diagnostic imaging was 4.28 (4th semester students), 4.08 (interns), and 4.2 (clinicians). Mean perception scores of three groups are statistically significant for the contribution of anatomy education in development of professional skills and ethics of medicine ($p = 0.01$). About 26.7% of 4th semester students agreed and 40% strongly agreed to this fact and among interns 33.3% agreed, 16.7% strongly agreed to it. The perception score of the importance of anatomy education in improving the communication skills and teamwork was 3.65 (4th semester), 3.43 (interns), and 3.4 (clinicians). In addition, clinicians had felt that anatomy education helped in linking the knowledge of basic sciences with clinical sciences and it has improved their analytical and critical thinking; they gave a mean perception rating score of 3.1 and 3.5.

**Discussion**

The status quo changes in medical education, which calls for a deeper integration of basic and clinical sciences, have naturally impacted the face of anatomy education and demand incorporation of newer pedagogical strategies.\(^{19}\) It can be said that if the existing curricular framework is not remodeled according to the winds of change in medical education, anatomy would be easily perceived as a traditionalist and memory-based discipline.\(^{20}\) In addition, according to the newer educational paradigms adopted by the institution, (such as integrated curriculum), time available for anatomy education also gets constrained. The ever-expanding array of newer diagnostic methodologies, including the innovations in the way the body can be visualized (e.g., computed tomography, magnetic resonance imaging scans), require a specific level of anatomical knowledge.\(^{21}\) Similarly, the augmented importance of endoscopic and laparoscopic procedures demands a clinically orientated anatomy, in addition to the classical gross anatomy approach.\(^{22}\) The requirement of knowledge to interpret the images is often different from those that gained via conventional teaching methodologies. Despite its importance to various surgical and medical specialties, many curricula have undergone a decline in representation of anatomy.\(^{23,24}\) In the absence of a single prescription for revising the existing anatomy curricula, we made an attempt to analyze the patterns in the perceived relevance of anatomy among various stakeholders of our institute. By precisely knowing the influence of anatomy in clinical specialties, we would be able to develop supporting pedagogical strategies which reflect the increasing complexity and mutability of present-day medical education.\(^{25}\)

In a study by McLaren,\(^{26}\) when asked “How important do you think communication between clinicians and academic anatomists is to anatomy course development?” 88.5% of clinical year medical students, 94.8% academic anatomists, and 78.1% of clinicians rated 7/10, suggesting that the stakeholders of anatomical education agree that cooperation and input from both clinicians and academic anatomists enhance anatomical learning. In another study by Sbayeh et al.\(^{19}\), both practicing clinicians and anatomists had lower expectations of satisfactory anatomical knowledge among 4th year medical students. In another study by Fitzgerald et al.\(^{24}\), more than 44.2% of the newly qualified doctors surveyed, felt they had not received sufficient anatomy instruction in their undergraduate medical education and 16% desired that the clinical relevance of the anatomy should be given a greater emphasis.

In a study by Sbayeh et al.,\(^{19}\) clinicians were equivocal about the role of anatomy education in enabling them to function effectively in a clinical setting. In the present study, all three cohorts, that is, 4th semester students, interns, and clinicians perceived anatomy to be highly relevant to their day-to-day practice. In spite of the dramatic reduction in the duration available for anatomy teaching, we adopt the meticulous practice of dissection in our curriculum. In concordance with Rizzolo and Stewart\(^{29}\), we believe that the rhythm of dissection is analogous to the rhythm of clinical practice. Dissection involves steps which are congruent with the clinical practice. It requires distinguishing recognizable structures from unknown; interpretation of visualized structures to develop a differential identification and developing a mental plan for recognizing the structures in the future. In the present study, all three groups have strongly agreed to the fact that cadaver contact is very important in acquiring sufficient clinical knowledge, which facilitated them in learning clinical skills and analytical thinking.

Wenger\(^{30}\) placed learning in the context of our lived experience of participation in the world. Similarly, dissection hall involving team-based learning serves as a context for developing team skills and ability to follow complex instructions. We received an equivocal response from clinicians and interns for this question, compared with recently completed students. In our study, when compared with other cohorts, clinicians had de-emphasized the link between anatomy education and clinical sciences and minimized the contribution of anatomy toward lifelong self-directed learning. We presume that the old anatomy curriculum which largely involves didactic teaching and markedly demarcated from the clinical sciences would have made them feel in that way.

In the past 2 years, we have incorporated professionalism and ethics teaching activities in anatomy curriculum and presumably this might have reflected in a positive sense among recently completed students with 40% graded 5 in Likert scale. When asked regarding the role of anatomy in interpretation of radiological images, all three cohorts agreed with a strong positive response. On the other hand, anatomy education should try to shake of the image of being old fashioned and welcome radiological image-based anatomy teaching and make itself much more clinically orientated. When students get to apply their newly learned anatomical knowledge to real-life situations such as interpreting radiology images, they could easily perceive the significance of learning anatomy.
Table 4 Clinicians’ perspectives on importance of anatomical knowledge in various aspects of clinical care

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Question</th>
<th>Likert scale data (responses in %)</th>
<th>Mean (± SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patient history</td>
<td>3.3  10  26.7  30  30</td>
<td>3.3 (0.42)</td>
</tr>
<tr>
<td>2</td>
<td>Physical examination</td>
<td>0  3.3  10  26.7  60</td>
<td>3.9 (0.31)</td>
</tr>
<tr>
<td>3</td>
<td>Differential diagnosis</td>
<td>0  0  30  36.7  33.3</td>
<td>3.6 (0.22)</td>
</tr>
<tr>
<td>4</td>
<td>Treatment</td>
<td>6.7  6.7  13.3  40  33.3</td>
<td>3.2 (0.47)</td>
</tr>
<tr>
<td>5</td>
<td>Imaging and diagnostic studies</td>
<td>0  10  0  23.3  66.7</td>
<td>4.1 (0.38)</td>
</tr>
<tr>
<td>6</td>
<td>Arrival at provisional diagnosis</td>
<td>3.3  6.7  26.7  30  33.3</td>
<td>3.3 (0.42)</td>
</tr>
<tr>
<td>7</td>
<td>Arrival at final diagnosis</td>
<td>3.3  3.3  20  36.7  36.7</td>
<td>3.6 (0.37)</td>
</tr>
<tr>
<td>8</td>
<td>Communicating the condition with patient</td>
<td>0  20  30  26.7  23.3</td>
<td>3.3 (0.3)</td>
</tr>
<tr>
<td>9</td>
<td>Communication with colleagues</td>
<td>0  10  23.3  33.3  33.3</td>
<td>3.9 (0.23)</td>
</tr>
</tbody>
</table>

Abbreviation: SEM, standard error of the mean.

A study by Vorstenbosch et al. shows that junior medical doctors in particular use anatomical knowledge in all phases of the consultation, especially during physical examination.

Another objective was to document the clinician’s perceptions of anatomy in different phases of clinical setting (= Table 4). Clinicians in our survey perceived the role of anatomy in the clinic as important, particularly during the physical examination, interpreting radiological images, and communication with colleagues. However, they were equivocal regarding the role of anatomy in other domains such as arriving at the diagnosis and treatment. These findings are particularly relevant in the context where recommendations are made for structuring anatomy curriculum to enhance clinical reasoning skills. This can be explained by the “encapsulation theory” model which states that physicians become less aware of the foundational knowledge required for their clinical reasoning skills because they rely more heavily on comparisons of related clinical scenarios for reaching diagnosis.

Limitations

One of the limitations of the study was the limited sample size of the clinicians. However, we had managed to achieve the stipulated number required for generating minimal valid data. Additionally, the age of clinicians and their exposure to anatomy was varied. Our sample included early career faculties as well as much experienced faculties. We could not establish the exact stratification of the sample. Second, we chose the survey items which have been already validated. It was easy to administer the questionnaire to the students who understood the terminologies easily. But faculty were relatively ignorant about the role of newer terminologies such as critical thinking and self-directed learning in anatomy education. Fortunately, even with these limitations, the implications of our study findings appear to be applicable as it is congruent with other studies in the same domain.

Conclusion

The main aim of the present study was to echo the different levels of agreement/disagreement of each of the groups and thereby aid in developing recommendations for generating effective linkage between anatomy teaching and clinical practice. Our findings report several group differences with respect to various learning outcomes across all groups. Clinicians expressed their concerns regarding the missing link between anatomy teaching and clinical practice, largely because of the older school of anatomy education they had undergone in their undergraduate times. However, the present students expressed their positivity regarding expected learning outcomes which indicates the success of various initiatives we had implemented in the past few years. We recommend the curriculum designers to be aware regarding the perceptions expressed in our study while designing the curriculum. Our observations lead us to the following principles for rejuvenating anatomy education. First, anatomy should be presented in multiple formats including radiological and laparoscopic anatomy. Second, attempts should be made to inculcate inquiry-based learning among students which hones the clinical reasoning skills in the future. Third, anatomy education can be used as a stepping stone for generating group processes. To achieve this, every anatomist should distil the existing curriculum and incorporate newer innovative technologies, feasible to corresponding settings.

Conflict of Interest
None declared.

References

12 Raftery AT. Anatomy teaching in the UK. Surgery 2007;25:1–2
29 Rizzolo LJ, Stewart WB. Should We Continue Teaching Anatomy by Dissection When ...? Anat Rec (Part B: New Anat) 2006;289B: 215–218
30 Wenger E. Communities of Practice: Learning, Meaning and Identity. Cambridge: Cambridge University Press; 1998