Original Research Article

Medical students perception of ultrasound and computed tomography sessions in gross anatomy curriculum: a study in an Indian medical college

Subhramoy Chaudhury1*, Anasuya Ghosh1, Narayan Pandit2, Asit Chandra Roy2, Shankar Prasad Kabiraj2

1Department of Anatomy, North Bengal Medical College and Hospital, West Bengal, India
2Department of Radio Diagnosis, North Bengal Medical College and Hospital, West Bengal, India

Received: 29 January 2019
Accepted: 07 March 2019

*Correspondence:
Dr. Subhramoy Chaudhury,
E-mail: subhramoychaudhury@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Integration of Ultrasonography (USG) and Computed Tomography (CT) sessions into medical curriculum has been started and numerous studies show that they could be useful in anatomy teaching as an adjunct to traditional ways including didactic lectures, cadaveric material or 3D models. Information regarding the benefit and feasibility of integrating radiology sessions into Indian medical curriculum is still lacking.

Methods: We introduced didactic and practical sessions of USG and CT focusing on Liver morphology into first year anatomy course and found out student’s perception by Likert- scale type questionnaire at the end. We collected opinions once again from the same cohort during their clinical rotations as junior doctors regarding the effectiveness of radiological sessions at very beginning of their career.

Results: The first year students stated that radiology sessions were very interesting (97%) and effective (95%) to improve their anatomy understanding. 93% indicated it will make them more confident while taking practical examinations, 97% indicated such sessions should be incorporated in current anatomy curriculum. Majority of junior doctors (88% of responders) accepted the importance of early exposure to practical radiology in medical curriculum and recommended to include practical USG and CT sessions in anatomy course.

Conclusions: This study was first to experiment the impact of practical radiology sessions in anatomy and collect feedback from both first year students and junior doctors in an Indian medical college. Our study shows it is possible and beneficial to include structured ultrasonography and CT sessions to the present MBBS curriculum in conjunction with traditional teaching methods.

Keywords: Anatomy teaching, Medical students’ perception, Ultrasonography and CT scan

INTRODUCTION

The knowledge of human anatomy is the basis of health education- examination of patients and interpretation of radiologic investigations -thus helping in diagnosis and framing treatment plans. Anatomy knowledge is a key cornerstone in professional medical, dental and healthcare education.1 The anatomy curriculum and teaching modalities vary from country to country and the way of teaching anatomy is changing constantly. Traditional methods including didactic lectures, cadaveric pro section/dissection and use of anatomical models are
helpful aids to teach anatomy and they are commonly used in undergraduate medical anatomy courses in India.\textsuperscript{2,4} Aside from surface anatomy practical classes where students explore the surface projections of anatomy on each other, there is little opportunity for them to explore ‘living anatomy’.\textsuperscript{3} The traditional lecture-based anatomy teaching has a little effect on the learners in terms long lasting impact.\textsuperscript{6} The cadavers also present a number of disadvantages such as color, smell, texture and cannot be palpated or auscultated as in a real life.\textsuperscript{7}

Use of radiological techniques in anatomy teaching has rapidly progressed since late 1950. Absence of ionizing radiation and known adverse effects make ultrasonography more useful in teaching.\textsuperscript{8} Studying living anatomy using ultrasound adds a dynamic element to the anatomy learning that the cadaver cannot.\textsuperscript{9,10} Ultrasound offers in vivo visualization of anatomy and physiology as well as insight into pathological processes.\textsuperscript{5,11} Ultrasound training is beneficial in improving anatomy knowledge, develop basic imaging skills, aid in patient care in emergency set up and improve physical examination and patient assessment.\textsuperscript{12,21,9,14}

The learning tools as CT and MRI scans are gaining popularity to further reinforce the learning of anatomy in the practical setting.\textsuperscript{5,22} Introduction to CT, MRI scans during pre-clinical year orient medical students better in three dimensional anatomical relations, reinforce correlation of anatomy with pathological condition.\textsuperscript{23-28} These emphasize the importance of learning anatomy and help students in future clinical years and practicing career in any specialization.\textsuperscript{23-29}

Numerous studies show that live radiological techniques including ultrasonography (USG) and Computed Tomography (CT) could be useful in anatomy teaching as an adjunct to traditional ways. The benefit of integration of radiology into anatomy curriculum has been well proven across the world. Yet the concept has not been experimented by any Indian medical schools.

We introduced live sessions of ultrasonography and CT techniques during the first preclinical year of medical school during traditional anatomy coursework. We took the 1st year students to radiology department to observe patient based USG and CT sessions led by radiology professors and collected their feedback. We collected their opinion once again when they started clinical rotations as junior doctors after passing the final MBBS exam.

METHODS

We introduced practical USG and CT sessions focusing on ‘anatomy of liver’ into existing anatomy course of first year medical students at North Bengal Medical College and Hospital, India during 2013-14 session in an observational questionnaire-based study.

The study was approved by the institutional ethics and research committee. First year medical students were invited to participate in the study though participation was voluntary and had no bearing on a student’s standing in the course. Written consents were obtained from the medical students before commencing the study.

The study was conducted in four phases. In phase one, two didactic lectures (sixty minutes each) were delivered to the participating 1st year medical (MBBS) students by a senior radiologist form the department of Radiology. In these sessions, a precise information regarding radiology, diagnostic imaging procedures, radiological anatomy of liver and modality recognition techniques were discussed. CT, ultrasound images were used to familiarize medical students with the CT, ultrasound related radiologic anatomy and provide a foundation for interpreting those images in clinical practice. These ultrasound and CT lecture sessions were coordinated with cadaver based practical and theory sessions devoted to liver anatomy.

During phase two all the participating 103 first MBBS students were divided in to 7 groups according to their class roll numbers. On a previously scheduled date and time each group were taken to radiology department, NBMCH over a period of 2 weeks. Each group was exposed to a 30 minutes practical session on ultrasonography of liver followed by another 30 minutes session on CT scan of liver. Two professional Radiologists conducted the whole practical session for all the groups. The subjects for radiologic examinations were previously screened and consented healthy volunteers. Students were able to observe the radiology sessions in a real patient based clinical setting and interact with the professors who were conducting the procedure and giving live demonstration.

During phase three of the study, medical students were asked to complete a questionnaire. Five-point Likert scale type and open ended questions were used to assess agreement with statements regarding the learning experience. Fifteen specific questions addressing medical students’ perceptions of the integration of ultrasonography and CT teaching into their gross anatomy curriculum were included in the questionnaire. The questionnaire was designed by a multidisciplinary team of anatomists, radiologists and statisticians.

The questionnaires were distributed and collected anonymously to protect students’ confidentiality.

The last phase or phase four was performed after 5 years of the initial study during (2018) which the aforementioned medical students already passed final year MBBS exam and were doing rotatory internship in various clinical disciplines. 85 students of 2013-14 study cohort were doing clinical rotations during 2018-19 and their contact emails were obtained (from students’ record section of NBMCH). All the students were sent a new questionnaire having Likert scale type and open ended
questions based on the radiological sessions during their first year of medical college. They were requested to complete and send it back within one month. 17 students responded with a completed questionnaire, all the responses were tabulated and data analysis was performed. It was assumed that the majority of students (85-17=68; 80%) could not recall the events properly which took place 5 years back.

One resident physician blinded to the study hypothesis entered all questionnaire data into an Excel spreadsheet (Microsoft) manually. Descriptive analyses were performed using Statistical Package for Social Scientists (SPSS) version 20 (IBM, Armonk, NY) software (Questionnaire responses were reported as percentage of total respondents) (Figures 1, 2, 3, 4).

![Figure 1: CT scan session on progress.](image1.jpg)

![Figure 2: Ultrasound session on progress.](image2.jpg)

![Figure 3: Feedback session of first year medical students on progress.](image3.jpg)

RESULTS

There were 103 first-year medical students enrolled in this study though 90. 29 % students (56 male, 37 female) returned a completed questionnaire at the end and were included in the study. All the students were Indian national, aged between 18-30 years (Figure 5). Data reentry by a second investigator showed 100% agreement

Ninety eight percent (98%) students felt that size of the small group (ranging between 14-16 students) was optimum, they all could see the screen monitors well and had a clear hearing of the professor’s narrations during the sessions. 94% of them found all the three sessions (didactic lectures, one USG and one CT scan) were very interactive (Table 1).
An overwhelming number of medical students (95%) felt CT; ultrasound sessions will improve their anatomy knowledge and durability of the knowledge as they found the session motivated them to do self-study about the gross anatomy and histology of the organs.

Ninety five percent (95%) students indicated that CT; ultrasound-based teaching will increase their confidence to perform better in practical examination in anatomy because it clarified anatomy concepts and improved visualization. 92% felt that this early exposure of USG and CT sessions helped them to understand their clinical importance and application; scope to interact with radiologists was additional gain. 91% of students could well correlate the radiologic structures with gross dissected specimens during the sessions. 94% of them indicated that CT scan views improved their gross anatomy understanding as it improved their 3D orientation.

Figure 5: Age distribution of 1st year medical students.

Table 1: Feedback responses obtained from first year medical students.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Agree response (%)</th>
<th>Disagree response (%)</th>
<th>Undecided (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group size was optimal</td>
<td>98</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Interaction was good</td>
<td>94</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Sessions improved anatomy knowledge</td>
<td>95</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Durability of knowledge will rise</td>
<td>95</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Improve in practical exam/score</td>
<td>95</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Awakened interest in clinics</td>
<td>96</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Gave an early clinical exposure</td>
<td>92</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Structures well correlated in CT &amp; USG</td>
<td>91</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Ct scan cleared my view</td>
<td>94</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Only CT scan is sufficient</td>
<td>55</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>Only usg is sufficient</td>
<td>57</td>
<td>13</td>
<td>30</td>
</tr>
<tr>
<td>Ct cleared view of ultrasound</td>
<td>57</td>
<td>36.5</td>
<td>6.5</td>
</tr>
<tr>
<td>More sessions will improve my anatomy</td>
<td>97</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Usg and CT should be in curriculum</td>
<td>97</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Liked the session</td>
<td>97</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Feedback responses obtained from junior doctors.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Agree response (%)</th>
<th>Disagree response (%)</th>
<th>Undecided (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiology sessions in first year highlighted the need of anatomy knowledge in clinical practice</td>
<td>70</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Anatomy knowledge is essential to interpret radiological images for day to day patient care</td>
<td>82</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Inclusion of CT and USG sessions into 1st year anatomy curriculum is suggested</td>
<td>88</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Hands-on training in USG in subsequent years would help to become a competent physician</td>
<td>35</td>
<td>34</td>
<td>31</td>
</tr>
</tbody>
</table>

Almost all of them (97%) would like to participate more session like this and felt that CT; ultrasound should be well fitted in the present MBBS curriculum as it generates interest and exposes to a larger learning atmosphere (Table 2).
Analysis of questionnaire of the phase four of study showed that, out of 17 responders 15 students (approx. 88%) recommended inclusion of practical radiology sessions in anatomy curriculum and 14 students (approx. 82%) admitted that anatomy knowledge is essential to interpret radiological images for day to day patient care in the clinical discipline they are in. 6 (approx. 35%) of them suggested hands on training of ultrasonography in subsequent years of medical school could be helpful to become a competent physician.

**DISCUSSION**

We present here the perception of first year medical students about practical USG and CT scan sessions during their anatomy course and the opinion of junior doctors during clinical rotations about inclusion of radiology sessions in anatomy curriculum.

In our study, the majority of first-year MBBS students found CT-ultrasound sessions (didactic and practical) very effective (95%) and enjoyable (97%) in learning gross anatomy adjunct to traditional teaching. They (97%) believed it is possible and helpful to include radiological sessions in anatomy curriculum. These findings support the results of the study conducted by Brown et al. 93% students believed that radiology exposure will increase their confidence to perform better in practical exams and of invasive procedures.

This finding has been supported by another study by Butter et al. 91% of students could well correlate the radiologic structures with gross dissected specimens of liver. A study conducted by Philips et al had the similar finding that students can well co-relate the dissected cadaveric structures and radiological images with or without correlative instruction sessions. The 1st year medical students expressed they would like to have more sessions of ultrasound and CT scan which is supported by other study findings.

In the phase four study, only 20% junior doctors responded. Most of them (88%) recommended to include radiological sessions into the anatomy curriculum. They accepted the importance of integrating gross anatomy and radiology from very beginning of career. Some of them (35%) believed that hands-on training on ultrasound in subsequent years covering specific areas of body could be helpful in making competent physicians-some previous studies supported this belief by assessing students’ performance after hand-on sessions. If multiple radiology sessions could be arranged focusing on different areas of human body, the study could create a greater impact and better memory for the students in a long term basis.

There were several methodological limitations, including a small sample size. As with any survey study, results were dependent on the validity of the self-reported data.

The other limitations of our study were following-1. The radiology exposure of 1st year students was limited to one organ only 2. We did not compare the students’ perception difference between CT scan and ultrasound sessions in details 3. We did not evaluate students’ understanding and interpretation of liver radiology images by any formative assessment 4. Hands-on training/exposure of radiological techniques could not be included (due to shortage of time and unavailability of instruments). Future studies could focus on hands-on training and the long-term benefits related to patient care from early exposure to CT-ultrasound technology in medical curricula.

The unique features of our study were 1. It was the first experiment of introducing Ultrasound and CT sessions in undergraduate medical curriculum in an Indian medical school, where students were taken to radiology department to observe real patient based sessions of both Ultrasound and Tomography with interactive demonstration by the radiologist conducting the procedure.

The feedback and suggestion were collected from the same cohort of students as the first year medical students and after 5 years as junior doctors. As the first year medical students have very limited exposure to clinics, we wanted to cross check their opinion when they were doing clinical rotations as junior doctors and participating in day to day patient care services.

**CONCLUSION**

We found that medical students appreciated the use of CT scan and ultrasonography as an adjuvant teaching tool to traditional system with great enthusiasm and interest. Majority of them believed it is possible and beneficial to include the CT and ultrasonography in the present MBBS curricula in India. This effort provided an early clinical exposure and awareness about direct correlation of anatomy knowledge in patient care. It would be timely and necessary to expose the medical students to ultrasound and CT sessions in a structured way during traditional anatomy course-from the very beginning of their medical career.

**ACKNOWLEDGEMENTS**

Authors would like to thank Dr. Partha Pal for statistical analysis, Dr. Sabyasachi Das, for the administrative supports and logistics; faculties of Radiology department for their time and help; faculties of Anatomy departments for their support and medical students for their participation and feedback.

**Funding:** No funding sources

**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee of North Bengal Medical College, West Bengal, India
REFERENCES
