

Original Research Article

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

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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' 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.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”.⁵ The traditional lecture-based anatomy teaching has a little effect on the learners in terms long lasting impact.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.⁷

Use of radiology techniques in anatomy teaching has rapidly progressed since late 1950. Absence of ionizing radiation and known adverse effects make ultrasonography more useful in teaching.⁸ Studying living anatomy using ultrasound adds a dynamic element to the anatomy learning that the cadaver cannot.^{9,10} Ultrasound offers in vivo visualization of anatomy and physiology as well as insight into pathological processes.^{6,11} 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.^{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.^{4,22} 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.²³⁻²⁸ These emphasize the importance of learning anatomy and help students in future clinical years and practicing career in any specialization.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 from 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 30minutes 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 ultrasound 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 NBMC&H). 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.



Figure 1: CT scan session on progress.



Figure 2: Ultrasound session on progress.



Figure 3: Feedback session of first year medical students on progress.

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).

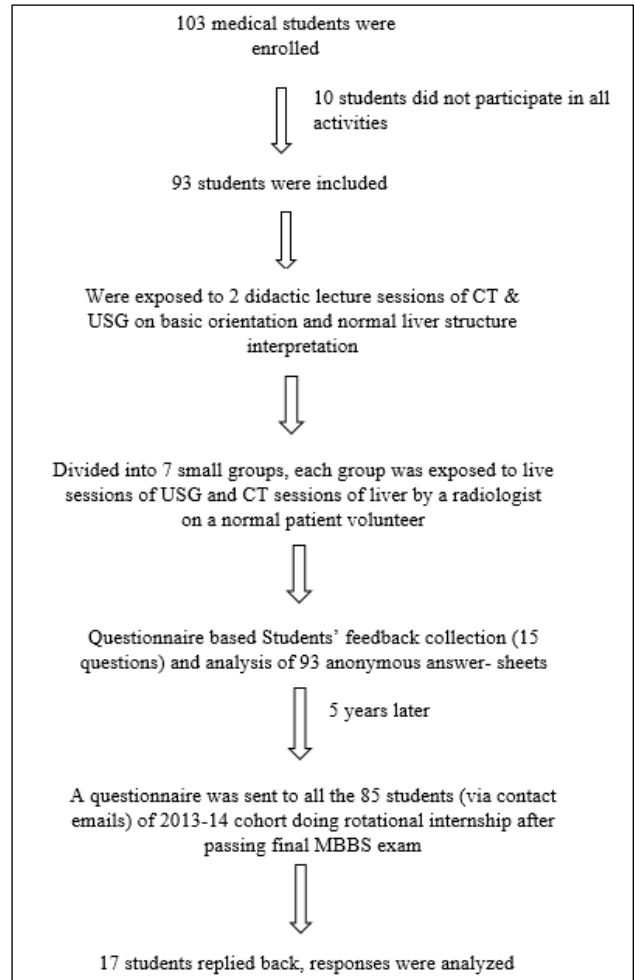


Figure 4: Sequence of events in the study.

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).

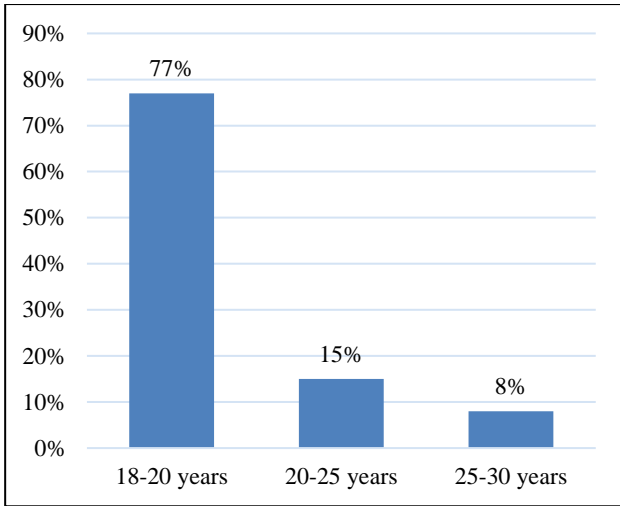


Figure 5: Age distribution of 1st year medical students.

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.

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

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

Table 2: Feedback responses obtained from junior doctors.

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

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.³⁰ 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.⁹ 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.³¹ 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.¹⁷⁻¹⁹

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.^{21,23-29} 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.

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REFERENCES

1. McLachlan JC, Patten D. Anatomy teaching: ghosts of the past, present and future. *Med Educ.* 2006;40:243-53.
2. Aziz MA, McKenzie JC, Wilson JS, Cowie RJ, Ayeni SA, Dunn BK. The human cadaver in the age of biomedical informatics. *Anat Rec.* 2002;269:20-32.
3. Pawlina W, Lachman N. Dissection in learning and teaching gross anatomy: Rebuttal to McLachlan. *Anat Rec.* 2004;281:9-11.
4. Gunderman RB, Wilson PK. Viewpoint: Exploring the human interior: The roles of cadaver dissection and radiologic imaging in teaching anatomy. *Acad Med.* 2005;80:745-9.
5. Patten D, Donnelly L, Richards S. Studying living anatomy: The use of portable ultrasound in the undergraduate medical curriculum. *IJOCS.* 2010;4:72-6.
6. Rizzolo LJ, Stewart WB, O'Brien M, Haims A, Rando W, Abrahams J, Dunne S, Wang S, Aden M. Design principles for developing an efficient clinical anatomy course. *Med Teach.* 2006;28:142-51.
7. Chan LK, Ganguly PK. Evaluation of small group teaching in human gross anatomy in a Caribbean medical school. *Anat Sci Educ.* 2008;1:19-22.
8. Barnett SB, Kossoff G, Edwards MJ. Is diagnostic ultrasound safe? Current international consensus on the thermal mechanism. *Med J Aust.* 1994;160:33-7.
9. Butter J, Grant TH, Egan M. Does ultrasound training boost Year 1 medical student competence and confidence when learning abdominal examination? *Med Educ.* 2007;41:843-8.
10. Ivanusic J, Cowie B, Barrington M. Undergraduate student perceptions of the use of ultrasonography in the study of "living anatomy". *Anat Sci Educ.* 2010;3:318-22.
11. Sugand K, Abrahams P, Khurana A. The anatomy of anatomy: A review for its modernization. *Anat Sci Educ.* 2010;3:83-93.
12. Teichgräber UK, Meyer JM, Poulson Nautrup C, von Rautenfeld DB. Ultrasound anatomy: a practical teaching system in human gross anatomy. *Med Educ.* 1996;30:296-8.
13. Heilo A, Hansen AB, Holck P, Laerum F. Ultrasound 'electronic vivisection' in the teaching of human anatomy for medical students. *Eur J Ultrasound.* 1997;5:203-7.
14. Rao S, Holsbeeck LB, Musial JL et al. A pilot study of comprehensive ultrasound education at the Wayne State University School of Medicine. *J Ultrasound Med.* 2008;27:745-9.
15. Zumwalt AC, Lufner RS, Monteiro J, Shaffer K. Building the body: active learning laboratories that emphasize practical aspects of anatomy and integration with radiology. *Anat Sci Educ.* 2010;3(3):134-40.
16. Mircea PA, Badea R, Fodor D, Buzoianu AD. Using ultrasonography as a teaching support tool in undergraduate medical education-time to reach a decision. *Medical Ultrasonography.* 2012;14:211-6.
17. Tshibwabwa ET, Groves HM. Integration of ultrasound in the education programme in anatomy. *Med Educ.* 2005;39:1148.
18. Tshibwabwa ET, Groves HM, Levine MA. Teaching musculoskeletal ultrasound in the undergraduate medical curriculum. *Med Educ.* 2007;41:517-8.
19. Wicke W, Brugger PC, Firbas W. Teaching ultrasound of the abdomen and the pelvic organs in the medicine curriculum in Vienna. *Med Educ.* 2003;37:476.
20. Wittich CM, Montgomery SC, Neben MA, Palmer BA, Callahan MJ, Seward JB, Pawlina W, Bruce CJ. Teaching cardiovascular anatomy to medical students by using a handheld ultrasound device. *JAMA.* 2002;288:1062-3.
21. Yoo MC, Villegas L, Jones DB. Basic ultrasound curriculum for medical students: validation of content and phantom. *J Laparoendosc Adv Surg Tech A.* 2004;14:374-9.
22. Lufner RS, Zumwalt AC, Romney CA, Hoagland TM. Incorporating radiology into medical gross anatomy: Does the use of cadaver CT scans improve students' academic performance in anatomy? *Anat Sci Educ.* 2010;3:56-63.
23. Jang HW, Oh CS, Choe YH, Jang DS. Use of dynamic images in radiology education: Movies of CT and MRI in the anatomy classroom. *Anatomical sciences education.* 2018 Nov;11(6):547-53.
24. Kumar PA, Jothi R, Mathivanan D. Self-directed learning modules of CT scan images to improve students' perception of gross anatomy. *Education for Health.* 2016;29:152-5.
25. Slon V, Hershkovitz I, May H. The value of cadaver CT scans in gross anatomy laboratory. *Anat Sci Educ.* 2014;7:80-2.
26. Machado JA, Barbosa JM, Ferreira MA. Student perspectives of imaging anatomy in undergraduate medical education. *Anat Sci Educ.* 2013;6:163-9.
27. Gunderman RB, Siddiqui AR, Heitkamp DE. The vital role of radiology in the medical school curriculum. *AJR Am J Roentgenol.* 2003;180:1239-42.
28. Bohl M, Francois W, Gest T. Self-guided clinical cases for medical students based on postmortem CT scans of cadavers. *Clin Anat.* 2011;24:655-6.
29. Nagar SK. Newer approaches of anatomy teaching. *National J Med Res.* 2012;2:1.
30. Brown B, Adhikari S, Marx J, Lander L, Todd GL. Introduction of ultrasound into gross anatomy curriculum: perceptions of medical students. *J Emergency Med.* 2012;1:5.
31. Philips AW, Smith SG, Ross CF, Straus CM. Direct correlation of radiologic and cadaveric structures in a gross anatomy course. *Medical Teacher.* 2012;34(12):e779-e784.

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