Medical Education

Early clinical exposure through innovative interactive clinical anatomy lectures

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ABSTRACT

Background. Traditional lecture-based teaching of anatomy tends to focus on the discipline per se rather than relating it to clinical conditions. As a result, students often lose interest in the basic sciences. We hypothesized that a lecture format that encourages students to relate anatomy to case presentations might help them in appreciating clinical relevance. We therefore proposed to develop, implement and evaluate innovative interactive clinical anatomy lectures (ICALs) for first year medical students of our institution as a method to implement the 'early clinical exposure' teaching strategy being promoted by the Medical Council of India.

Methods. The first year medical students ($n = 150$) were divided into two groups by lottery: the study group ($n = 75$) and the control group ($n = 75$). The study group received nine ICALs along with traditional gross anatomy lectures (TGL) and dissection. The control group received only TGL along with dissection. A post-test in clinical anatomy was conducted for both groups. The responses of the study group on TGL and ICALs on their learning and understanding of the clinical conditions were collected using the nominal group technique.

Results and conclusion. It is feasible to introduce early clinical exposure within lectures even with 150 students. There was a statistically significant ($p < 0.001$) difference in the mean post-test scores of the two groups, which shows that ICALs are effective in correlating anatomical and clinical information to students. The nominal group technique responses of the study group showed that they appreciated it as a better method of teaching and learning.

Natl Med J India 2015;28:291–4

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INTRODUCTION

The World Federation for Medical Education's Global Standards for Basic Medical Education state that medical schools should 'ensure vertical integration of the clinical sciences with the basic biomedical and the behavioural and social sciences'.[1] This links with Drake's call to 'train the medical student to become a physician'.[2]

The context for the need to change

Although the Medical Council of India (MCI) has recommended vertical and horizontal integration between disciplines, most medical colleges follow the traditional subject-based curriculum with faculty teaching their discipline in a lecture setting supplemented by facilitating students' exploration in the laboratory, with little or no integration across other disciplines. Thus, students largely memorize facts and do not correlate their learning with its application to future clinical situations when they would be practising as doctors.

This is especially true with traditional lecture-based anatomy teaching which tends to focus on the discipline rather than relating it to understanding and solving clinical conditions. For example, students typically spend 2.5 hours daily in dissection of a particular anatomical region (e.g. the inguinal canal) followed by 1 hour of a traditional gross anatomy lecture (TGL) on that topic which mostly covers the anatomical aspects with a few minutes for clinical anatomy towards the end. Thus, the lectures do not motivate students sufficiently to study the discipline with the intensity it deserves.

Early clinical exposure (ECE) as an educational strategy

ECE has been tried in many parts of the world to motivate first year medical students to learn the basic sciences. A best evidence in medical education (BEME) systematic review of 73 studies on the benefits of ECE concluded that it makes the students' learning of basic sciences more real and relevant.[3] ECE also marks the beginning of active, lifetime learning from patients early in medical education.[4] Other studies have also corroborated that introduction of clinical medicine early, using real clinical situations makes teaching more practical, relevant and reinforces vertical integration of the basic medical sciences with clinical sciences.[5] A survey of students showed that they want to learn clinical application of the basic sciences. They also felt that ECE was a lifeline that allowed them to focus on their studies.[6] It was also shown that there is no 'best' way of implementing ECE and so ECE has to be tailored to the local needs.[7]

The MCI has also recommended the introduction of ECE as a teaching strategy in the first year of medical curriculum. However, a search of the educational literature from India does not show any

replicable and evidence-based models of ECE for teaching anatomy.

Hence, there is a need to develop, implement and evaluate effectiveness of a replicable model of interactive clinical anatomy lectures (ICALs) for ECE with clinical scenarios within the lecture series for first year medical students, which will motivate students to learn anatomy.

METHODS

We obtained clearance from the Institutional Ethics Committee and followed standard recommendations for carrying out educational research. A subject information sheet was distributed to all the students and informed consent obtained from them. We presented an overview of the study which outlined the roles of all participants of the study.

Study design

We used a mixed methods design by combining a randomized (by lottery method) study to present evidence of the effectiveness of the intervention and used qualitative research methods to capture the reactions of the students towards the new learning experience and its contribution to understanding the relevance and motivation to learn a basic science subject. All 150 first year medical students of the 2012–13 batch of our institution were included and divided equally, by lottery, into the study group (SG) and the control group (CG).

Teaching methodology common to both groups

Both groups were taught gross anatomy of the abdomen through a combination of dissection and lectures related to the part dissected. In dissection, both groups were demonstrated and taught detailed gross anatomy of the topic dissected (e.g. the inguinal canal) with a brief description of clinical anatomy. This was followed by a TGL (e.g. the inguinal canal) for both groups which lasted for 1 hour with a detailed description of the gross anatomy of the inguinal canal with clinical anatomy on the same topic being taught at the end of the lecture for a few minutes.

Innovative teaching methodology for the SG

The innovative intervention included structured teaching of clinical anatomy related to gross anatomy of the abdomen using ICALs. The content of ICALs was based on the nine must-know clinical conditions related to anatomy of the abdomen according to the affiliated university syllabus. Preparation for the ICALs included preparing model lesson plans, PowerPoint presentations, case study handouts, feedback questionnaires, post-test questionnaire, a manual on clinical anatomy and a CD containing PowerPoint presentations of all the lectures. The ICAL series consisted of nine interactive clinical anatomy lectures on inguinal hernia, hydrocoele, varicocoele, peptic ulcer, carcinoma of head of pancreas, acute appendicitis, cirrhosis of the liver with portal hypertension, ureteric colic and acute cholecystitis. All the ICALs for the SG were done after the dissection and TGL on the topic, on the next day and were taken by a single faculty member (KR). Each ICAL session lasted for 30 minutes and was divided into multiple interactive segments. It consisted of an outline of the lecture segments, introduction of the clinical condition through a case study, briefing of relevant gross anatomy with questions and buzz groups, clinical features, a segment on case discussion and a summary (*see* Appendix 1: Model lesson plan).

While this session was going on, students in the CG were divided into smaller groups with one faculty member assigned to each group. These groups had interactive revision sessions guided by the tutors in the dissection hall.

Measuring effectiveness of the intervention

Evaluation of the ICALs was done at two levels:

1. Student reaction (Kirkpatrick level 1) to the innovation (to capture acceptance/usefulness)
2. Student learning (Kirkpatrick level 2) from the innovation (proof of benefit).

Student reaction. Student reaction about the ICALs was elicited in two ways: (i) students' feedback rating the usefulness of ICALs on six items using the Likert scale (*see* Appendix 2: Students' feedback on ICALs related to the abdomen). The items listed were checked for internal construct reliability (Cronbach alpha 0.865 or 86.5%); and (ii) students' perceptions about the process and contents of ICALs using the nominal group technique (NGT).

The NGT discussion was done by dividing students in the study group into eight subgroups with one faculty facilitator from the departments of anatomy, microbiology, pharmacology and community medicine. This was done to systematically obtain students' views on the effectiveness of ICALs in contributing to the process and content of learning. All eight subgroups processed the evaluation items and the top five responses that emerged from each subgroup were tabulated. Overlapping responses were merged and the scores obtained were analysed.

The NGT discussion was divided into five steps. In step one (individual reflection) the students in the subgroup were asked to reflect individually on two items. These were (i) list the effects of traditional lecture method and the new teaching method on your learning (focusing on the process of the interactive lecture) and (ii) list the ways in which the traditional lecture and the new teaching method affected your understanding of clinical conditions (focusing on the clinical anatomy content of the lecture). In step two (collating views) the faculty facilitator asked each student to contribute one response to the above-mentioned evaluation items. At this stage no comments were made apart from those relating to the meaning or clarification of a concept. In step three (rationalizing) the compiled list was discussed by the subgroup and overlapping or similar points were rationalized. In the final step (setting priorities) the subgroup members reviewed the final list individually and selected their five most important points and ranked them from 1 to 5, allocating 5 points to the most important aspect and 1 point to the least important aspect. These scores were written next to the statement on the flip chart, the scores were then added up and the subgroup's view of relative importance of the points was obtained.

Student learning. As both groups of students were taught clinical anatomy, a post-test was administered to both groups and the scores obtained were analysed. The post-test comprised modified essay questions, short notes and short answer questions; it was for 1 hour and had a maximum score of 40 marks. The post-test questions tested knowledge in gross anatomy and clinical anatomy and the ability to correlate one with the other.

Statistical analysis

Student learning was measured by comparing the post-test scores of the SG and CG using Student *t* test (independent). Comparison of the feedback of the SG about ICALs was done using a summated score of the feedback item. A p value of <0.05 was considered statistically significant in a 2-tailed test.

RESULTS

Student learning with ICALs

The mean (SD) post-test score of the SG was 22.5 (8.3) and of the CG 9.2 (6.7) and was statistically significant ($p<0.001$).

Students' perception of usefulness of ICALs

Students perceived ICALs to be superior to traditional methods in terms of it being less boring (more interesting), more interactive with active participation of the student and better able to correlate basic with clinical anatomy (Table I). The top five responses on the NGT scores (Table II) show that the SG students felt that they understood clinical anatomy and the clinical condition better with ICALs. Also none of the SG students had any negative views about the ICALs.

Students' feedback on ICALs

More than one-third of students (36.5%) found ICALs to be exceptional, half of them rated these very good and 13.5% of students found these good. No student rated the ICALs either poor or satisfactory.

DISCUSSION

Anatomy is the foundation on which clinical medical education is built. It has also been considered a narrative science that introduces students to the terminology of medicine.[8] Adding clinical and applied aspects to traditional teaching gives anatomy teaching a 3-dimensional view, while incorporating interactive lectures gives it a multidimensional approach.

Learning is an active process and students who learn actively may learn better than passive learners.[9]

There has been an ongoing debate as to which method of teaching is superior. Johnson *et al*. concluded that a modernized anatomy curriculum integrating traditional lectures with models, radiological imaging, computer-assisted learning and problem-based learning might be beneficial for students. Anatomy being the portal of entry to the medical curriculum, if taught in an integrated manner, might be of benefit to students especially when they move on to clinical training.[10] Johnson *et al*. introduced clinical association lectures in which clinicians were invited to give lectures and to guide problem-based learning case studies. They observed that when clinicians involved themselves, students showed more interest in clinical anatomy lectures.

Drake describes a clinically orientated approach to medical education called 'case-directed anatomy' in which clinical cases are used to introduce concepts and facts of anatomy. The interactive clinical case discussions were guided by a clinician.[11]

We introduced ICALs to first year medical students. These lectures are of shorter duration (30 minutes), interactive, focus on clinical anatomy and are taken by teachers of anatomy. This approach can be implemented for a larger group of students. The topics chosen were those related to clinical anatomy (e.g. inguinal hernia) and were focused on correlating gross anatomy with the clinical features. In ICALs, a clinical case study is discussed for students to understand the anatomical basis of the clinical condition. The results of such an innovation are evident from the completely contrasting responses given by students on traditional and interactive clinical anatomy lectures (Tables I and II). Our data show that students in the SG performed better in clinical anatomy than those in the CG. To the best of our knowledge, no similar reports from India have addressed teaching of clinical anatomy by ICALs.

The overall rating of ICALs by the SG students was 86.5% (very good and exceptional) and the rest (13.5%) rated it as good. None of the students found it poor or satisfactory. This suggests a high level of acceptance of ICALs by students as a method for teaching anatomy.

In his interview of 100 anatomists and 100 students, Nayak *et al*. observed that not only students but teachers too expressed a need to the teach clinical anatomy and reinforced the need for an integrated curriculum that is clinically relevant.[12]

In another study, feedback from medical students on teaching of gross anatomy suggested that 90% of students felt the need for an enhanced stress on clinically oriented anatomy.[13]

We observed that the top five responses tabulated from the

TABLE I. Students' reaction about their learning in the two groups

No.	Response for main effect of traditional lecture on your learning	Scores	Response for main effect of new method (interactive teaching) on your learning	Scores
1.	Long hours, boring	108	Able to share, interactive, active participation of students, able to correlate and study well	119
2.	Vague, feeling sleepy	87	More knowledge is gained	91
3.	Non-interactive	86	Short and crisp, effective	86
4.	More textbook-based	85	Interesting, very interesting	69
5.	Cannot recollect	61	Quick to understand	60

TABLE II. Students' reaction about understanding of the clinical anatomy in the two groups

No.	Response for main effect of traditional lecture on your understanding of the clinical condition	Scores	Response for main effect of new method (ICALs) on your understanding of the clinical condition	Scores
1.	More focus on gross anatomy and not on clinical application	107	Helps to correlate gross with clinical anatomy	153
2.	Importance not given to clinical anatomy	77	More understanding of clinical anatomy, easy to understand clinical anatomy	151
3.	Less understanding of clinical anatomy	63	Discussing case study leads to better understanding of the clinical condition	128
4.	Provides less clinical correlation, not able to correlate with gross anatomy	50	Provides extensive knowledge in clinical anatomy	60
5.	Correlation between gross and clinical anatomy not taught	48	Gives confidence in answering clinical anatomy, made us confident in clinical anatomy	40

ICALs interactive clinical anatomy lectures

NGT process indicate that students prefer ICALs to TGL. Also, students' feedback after the ICALs shows that they appreciate this form of ECE. Some students stated: 'Teaching with clinical cases made us understand gross anatomy better' and 'Exposure to clinical case, in the first year itself, made learning interesting.' It also motivated them to learn anatomy: 'Helped us to correlate gross anatomy with the clinical condition' and '… makes us a better doctor'. It made the sessions less boring: 'case studies made us interact, were thought-provoking', and '… learnt complicated concepts in a simple way'. It also made them more confident in dealing with clinical cases in clinical years: 'We will be more confident in dealing with clinical cases in clinical years' and '… motivated us to study clinical medicine'. These reactions of students show that we were able to achieve our goal of delivering interactive lectures with relevance to clinical application and thus motivating them to learn anatomy.

The already reduced number of teaching hours in anatomy will be a constraint in implementing ICALs. However, considering the advantages that ICALs offer, such as short duration (30 minutes), the possibility of implementing with a larger group of students and the enhanced students' understanding of the anatomical basis of various clinical conditions, we propose that in addition to TGLs in teaching gross anatomy, ICALs can also be incorporated on some topics. We propose to induct actual patients instead of a case study for the next batch of students. This is in consonance with the recommendations of the MCI on ECE.

REFERENCES

1 World Federation for Medical Education (WFME). *Basic Medical Education WFME Global Standards for Quality Improvement: The 2012 revision.* WFME Office, Denmark:University of Copenhagen; 2012. Available at *www.wfme.org/standards/bme* (accessed on 19 May 2015).
2 Drake RL. Anatomy education in a changing medical curriculum. *Anat Rec* 1998;**253:**28–31.
3 Dornan T, Littlewood S, Margolis SA, Scherpbier A, Spencer J, Ypinazar V. How can experience in clinical and community settings contribute to early medical education? A BEME systematic review. *Med Teach* 2006;**28:**3–18.
4 Wartman S, Davis A, Wilson M, Kahn N, Sherwood R, Nowalk A. Curricular change: Recommendations from a national perspective. *Acad Med* 2001;**76** (4 suppl):S140–S145.
5 General Medical Council. *Tomorrow's doctor: Recommendations on undergraduate medical education.* London:General Medical Council; 1993.
6 O'Brien-Gonzales A, Blavo C, Barley G, Steinkohl DC, Loeser H. What did we learn about early clinical experience? *Acad Med* 2001;**76** (4 suppl):S49–S54.
7 Abramovitch H, Shenkman L, Schlank E, Shoham S, Borkan J. A tale of two exposures: A comparison of two approaches to early clinical exposure. *Educ Health (Abingdon)* 2002;**15:**386–90.
8 Educational Affairs (EA) Committee, American Association of Clinical Anatomists. A clinical anatomy curriculum for the medical students of the 21st century: Gross anatomy. *Clin Anat* 1996;**9:**71–99.
9 Gulpinar MA, Yegen BC. Interactive lecturing for meaningful learning in large groups. *Med Teach* 2005;**27:**590–4.
10 Johnson EO, Charchanti AV, Troupis TG. Modernization of an anatomy class: From conceptualization to implementation: A case for integrated multi modal–multi disciplinary teaching. *Anat Sci Educ* 2012;**5:**354–66.
11 Drake RL. A unique, innovative and clinically oriented approach to anatomy education. *Acad Med* 2007;**82:**475–8.
12 Nayak S, Ramanarayanan K, Somayaji SN. Anatomy that must be taught to a medical under graduate: An interview-based survey in Indian medical school. *Anat Rec B New Anat* 2005;**285:**16–18.
13 Holla SJ, Ramachandran K, Issac B, Koshy S. Anatomy education in a changing medical curriculum in India: Medical students feedback on the duration and emphasis of gross anatomy teaching. *Anat Sci Educ* 2009;**2:**179–83.

APPENDIX 1. Model lesson plan for interactive clinical anatomy lecture (ICAL)

Class: I MBBS, 75 students Time: 30 minutes

Topic: Inguinal hernia

Methods and media: Narration, case scenarios, buzz group, use of PowerPoint

Plan:

1. Outline objectives and segments: 2 minutes
2. Segment 1: Introduction of the topic through a clinical case study (case scenario of a patient with direct inguinal hernia): 2 minutes
3. Segment 2: Relevant gross anatomy of the inguinal canal re-emphasized (as this clinical anatomy lecture will follow a gross anatomy class on inguinal canal): 4 minutes
4. Segment 3: Buzz group—Posing a question, e.g. Discuss in groups of three and draw the deep and superficial ring: 3 minutes
5. Segment 4: Clinical features of inguinal hernia explained with relevant clinical pictures: 10 minutes
6. Segment 5: Discussion of the clinical case scenario with relevant questions; Think, pair and share: 5 minutes; e.g. what do you think in this patient is the predisposing factor for hernia to occur?, why do you think that the patient has got direct inguinal hernia and what is the anatomical basis for that?
7. Segment 6: Summary: 2 minutes

APPENDIX 2. Students' feedback on interactive clinical anatomy lectures on the abdomen

The following questionnaire is an important part of the evaluation of the 'Interactive clinical anatomy lectures on the abdomen'. It would take 15 minutes of your time but would be of great help in deciding if the same module can be extended to teaching gross anatomy of other regions of the body.

Direction: Please tick the appropriate answer

I. Please rate the interactive clinical anatomy lectures on the following items according to the scale following scale 1: Poor; 2: Satisfactory; 3: Good; 4: Very good; 5: Exceptional

S.No.	*Items*
1.	Clear and interesting
2.	Was interactive and short, and made me learn better
3.	Was thought-provoking
4.	Was relevant
5.	Has made me understand the anatomical basis of the clinical condition
6.	Has made me confident in answering clinical anatomy questions
7.	Overall rating

II. Do you think that the clinical anatomy lecture has made you understand the anatomical basis of the clinical condition?
a. Not at all b. To a little extent c. To some extent d. To a great extent

III. Do you think that the interactive lecture has made you learn better than the traditional non-interactive lectures?
a. Not at all b. To a little extent c. To some extent d. To a great extent

IV. What did you like about the lecture?

V. Give two suggestions for improving the lecture.

VI. Do you think the interactive clinical anatomy lectures can be extended to teaching gross anatomy of other regions? If yes, why?