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Research study

Basic Anatomy

Redeeming dissection course for medical undergraduates by compact structured schedules and frequent in-course assessments

R Bhatnagar, R Pokhrel*, A Tandon

Abstract

Introduction

Trends of doing away with dissection in anatomy are increasing worldwide for a variety of reasons. We have developed a strategy to redeem dissection by making it more purposeful and edit it to highlight clinical relevance using 90 structured dissection schedules and frequent in-course assessments.

Materials and methods

This strategy was tested by a longitudinal interventional study in medical undergraduates in the first year of preclinical phase. Out of 268 students, 134 were in a study group and the remaining 134 in a control group. Groups were similar in terms of age and sex composition and, prior academic performance. For the control group, dissection was performed using traditional methods and for the study group by the new strategy using 90 structured dissection schedules and weekly in-course assessments. Comparison of these groups was made in terms of their performance in three examinations spanning over one academic year.

Results

The study group performed better than the control group in both written and oral/practical parts of the first term, preliminary examinations and university examinations, the difference being statistically significant.

Conclusion

The threat to wreak havoc on the very edifice of medical education is to be countered by making dissection indispensable. It has been achieved by following a planned strategy that makes the student realise the importance of dissection. Dividing dissection course in well-defined schedules and conducting frequent in-course assessments improves the participation and performance of medical undergraduates.

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Introduction

The teaching of gross anatomy has, for centuries, relied on the dissection of human cadavers[1]. Past research suggests that students find work on a cadaver to be distressing, but also rewarding[2]. Hands-on educational experiences on cadavers can also stimulate student interest, increase knowledge retention and enhance development of clinical skills[3]. With increasing number of medical colleges and increased demand for cadavers together with technological advancement, utility of dissection has generated discussions, more so in the recent past, with favours growing towards the use of multimedia tools, computer software packages, models including plastinated specimens and imaging techniques[4–8]. The proponents of latter methods substantiate the views on the continuation of practice of dissection for and against rather convincingly[9]. Here, the point missed out is the aftermath of learning anatomy without dissection. These include, amongst other things, the subtle points and issues that would have immediate and long-term impact on medical education like missing the feel of the human structures, absence of evidence to develop imagination, inadequate opportunity to evolve reasoning, little scope to hone communication skills, no chance to strengthen camaraderie and ultimately the loss on stepping on the threshold that leads to one's own potential. The need to increase the efficiency of dissection in the gross anatomy laboratory has been the driving force behind the technologic changes we have recently implemented[6].

The aim of this work is to identify a strategy that makes dissection not only interesting but also more purposeful, clinically oriented and contribute more to the overall understanding of human anatomy within a limited time period. This approach would also make students enthusiastically participate in the dissection, comprehend and communicate the anatomical facts and grasp the clinical bearing of the part under dissection.

Materials and methods

It was an interventional longitudinal study, with a study sample consisting of 268 medical undergraduates of first-year bachelor of medicine and bachelor of surgery (I MBBS), in the preclinical phase of five-year bachelor entry course at our institution. These students were divided into two groups—study and control. Both groups were of equal size with similar age and sex composition and similar prior academic performance in terms of overall percentage obtained in high school (Grade XII) passing examination (see Table 1).

In the modified strategy, total dissection hours of an academic year are

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Table 1 Comparison of study and control groups				
	Sample size	Male/female ratio	Mean age in years	Mean percentage XII
Study group	134	108/26	18.53 ± 0.92	87.65 ± 5.27
Control group	134	108/26	18.77 ± 1.04	86.68 ± 7.37
P value	—	—	0.0485	0.217

Age of students and performance in high school are shown as mean ± standard deviation. ANOVA was done using Smith's statistical package; *P* value < 0.05 indicates statistically significant difference.

divided into 90 structured schedules of 2 h each; four such schedules are held per week. In each schedule, steps of dissection are well-defined and relevant anatomical structures, diagrams and core areas of learning mentioned. These schedules are published as manuals and made available to the students of study group. Examples of two such schedules and format of in-course assessment (ICA) are shown in Tables 2 and 3. The tabulated learning objectives for the dissection during the week are also displayed on the notice board of the department.

At the end of four dissection schedules spanning 1 week, an ICA is conducted in a structured format that includes four parameters. These parameters are:

- *Identify* the parts dissected.
- *Seek and show/enumerate* the structures dissected.
- *Explain/demonstrate* the pertaining anatomical facts.
- *Mention clinical aspect* of the part under dissection.

The correct responses from students are grouped into level I (must know), II (should know) and III (could know/good to know) as per their ascending order of complexity and understanding required. Students able to answer level I of each parameter are awarded one mark and additional one mark each for other levels. Maximum and minimum marks a student can be awarded in any station will therefore be 12 and 0 respectively. Performance of the students in ICA is displayed on the notice board on the first day of the succeeding week; these scores do not, however, contribute to marks of first term, preliminary and university examinations in any way.

Dissection classes for the control group were conducted by traditional methods using Cunningham's manual[10] for dissection, whereas for the study group it was done using the newer strategy. No ICAs were held for the control group.

First term, preliminary and MBBS I university exams are conducted at intervals spanning over an academic year for all the students enrolled and consist of written and oral/practical parts. For a detailed pattern of these examinations, please refer to the webpage of the Maharashtra University of Health Sciences[11]. Performance of two groups in these three examinations was compared to evaluate the efficiency of modified strategy adapted for dissection. Comparisons were made using ANOVA and $P < 0.05$ was considered statistically significant. Teachers directly involved in these examinations were not utilised in ICAs to prevent observer bias.

It was also noted that both groups had equal number of total hours available for dissection and equal time duration for self-study. Informed written consent was obtained from all the subjects. Since it is a longitudinal study, students of the control group were not deprived of new methodology as it was still under development. Cadavers used in the study were obtained by the body donation program of our department following all ethical guidelines. There were no dropouts from the study.

Results

Comparison of the study and control group revealed no statistical difference in age and sex composition as well as prior academic performance (see Table 1). Students in the study group performed better than the control group in both written and oral/practical parts of all the examinations conducted, that is first term, preliminary and university examinations. The difference in the score of the two batches is statistically significant (Table 4).

Discussion

Dissection of a human cadaver is a time-honoured tradition for teaching anatomy in medical education. However, in recent years, for a variety of reasons, including costs and ethical concerns, some medical programs have ceased cadaver dissection in exchange for virtual dissection of cadavers in cyberspace[2]. The traditional anatomy education based on topographical structural anatomy taught by didactic lectures and complete dissection of the body with personal tuition has been replaced by a multiple range of special study modules, problem-based workshops, computers, plastic models and many other teaching tools[12]. The paucity of cadavers is also weighing against the practice of dissection. In an era where the methods and time dedicated to the teaching of human anatomy are changing within medical curricula worldwide, it behooves anatomists to devise alternative strategies to effectively teach the discipline to medical students[12]. The students' participation and the instructors' interest get affected as confusion prevails due to lack of time. Further, dissection can be edited to make it more purposeful by making it more clinically relevant. Various workers have tried and tested methods that inadvertently attempt to redeem dissection.

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Table 2 Example of the dissection manual used in the study

SCHEDULE 2 AND 3: FEMORAL TRIANGLE AND ADDUCTOR CANAL								
Dissection steps	What is expected from the students						Summary	
	Must know	Fig	Should know	Fig	Could know	Fig	Identify	Understand
Clean the fascia and fat over the upper one-third of thigh to define boundaries of femoral triangle	Boundaries • Base: Inguinal ligament • Lat sartorius • Med add longus • Apex meeting of mentioned muscles	1					1. Boundaries of femoral triangle including floor 2. Femoral and profonda femoris A 3. Femoral vein and opening of GSV into it 4. Deep inguinal lymph nodes	1. Applied importance of GSV 2. Femoral canal and ring 3. Femoral hernia 4. Applied anatomy of femoral A 5. Exit of femoral Vs from femoral triangle
Clean the contents of triangle	From lat to medial • Femoral N and its 2 divisions • Femoral A and its deep branches • Profonda femoris • Deep external pudendal • Femoral vein with opening of Gr Saphenous vein into it • Deep inguinal lymph nodes	2	• Saphenous N	8	• Br from femoral N • Lat cut n of thigh • Femoral br of genito-femoral N	6 7 7		
Clean the muscular floor	Floor from lat to med: • Iliacus • Psoas major • Pectineus • Adductor longus	3					Applied aspects	
Clean the fat and fascia in middle one-third of thigh, lift and turn sartorius lat	Boundaries–adductor canal • Ant-lat: VM • Post: AL and AM • Roof: fascia stretching over these muscles and over which lies sartorius	8					1. Angiography 2. Venous graft from GSV in bypass surgery 3. IV injections 4. Femoral hernia and its repair 5. Popliteal A aneurysms 6. Stab injuries of thigh	
Expose the fascia b/w AL an VM and cut it longitudinally and identify the contents	Contents • Femoral Vs • Saphenous N • N to VM	8		8				

Dissection steps and core areas of learning for dissection schedule (2) and (3). Figures mentioned here are as depicted in manual.

The faculty of anatomy at the University of North Texas Health Science Centre (UNTHSC) has developed a computer-based dissection manual to adjust to their curricular changes and time constraints. Although they place a high priority on computerisation on the anatomy laboratory, they remain strong advocates of the importance of

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Table 3 Example of format of in-course assessment used in the study

ICA—SCHEDULES 2 AND 3: FEMORAL TRIANGLE AND ADDUCTOR CANAL			
Identify		**Seek and show/Enumerate**	
Level	Femoral triangle 1. Boundaries 2. Contents 3. Floor 4. Branches of femoral N 5. Branches of femoral A 6. Deep inguinal lymph nodes Adductor compartment 1. Muscles 2. Anterior division of obturator N and its branches Posterior division of obturator N and its branches Adductor canal 1. Roof of adductor canal	Level	Femoral triangle 1. Boundaries 2. Contents 3. Floor 4. Branches of Femoral N 5. Branches of Femoral A 6. Deep inguinal lymph nodes Adductor compartment 1. Muscles 2. Anterior division of obturator N and its brs 3. Posterior division of obturator N and its brs Adductor canal 1. Boundaries 2. Saphenous N 3. N to vastus medialis 4. Lat cut N of thigh 5. Femoral br of genito-femoral N 6. Obturator externus and obturator A
I Must know		I Must know	
II Should know	Nerve to pectineus	II Should know	Nerve to pectineus
Explain/Demonstrate		**Mention clinical aspects**	
Level	Femoral triangle 1. Exit of femoral A and its branches in femoral triangle 2. Actions of muscles forming femoral triangle Adductor compartment 1. Actions of muscles of adductor compartment Adductor canal 1. Roof of adductor canal	1. Compartments of thigh, muscle groups, their nerve supply and actions 2. Boundaries and contents of femoral triangle 3. Boundaries and contents of adductor canal 4. Course, relations and branches of femoral artery 5. Obturator N and its distribution	
I Must know			
ICA of dissection schedule (2) and (3).			

cadaver dissection[6]. Ellis emphasises the teaching in the dissecting room[5]. Likewise, McGarvey and colleagues hold dissection as a positive experience, and towards this they have prepared strategies that cope with the stress in the dissection hall[4].

A study similar to ours shows that students who had undertaken weekly ICAs showed significantly improved summative marks, compared with those who did not[13]. Another study shows that medical students grade dissection as the best method to learn anatomy compared to newer approaches such as models, computer software packages and living and radiological anatomy[14].

The time constraint has compelled the traditional teacher to only teach anatomy that is going to be clinically relevant to them in their subsequent practice[8]. The dissection room teaching when complimented by structured tests would make the student focused for learning and enthusiastically participate in dissection within

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Table 4 Comparison of mean scores of study and control groups in various examinations

Examination	I term		Preliminary		University	
Exam type	Theory	Practical	Theory	Practical	Theory	Practical
Control group	38.12 ± 11.48	44.94 ± 8.59	48.23 ± 10.28	49.14 ± 8.82	57.97 ± 6.75	66.52 ± 8.58
Study group	51.31 ± 9.78	51.02 ± 8.49	51.07 ± 8.66	52.03 ± 8.20	60.06 ± 6.70	70.09 ± 6.91
P value	1.35×10^{-20}	2×10^{-8}	0.0151	0.0058	0.0118	0.0002

Scores are depicted in percentage as mean ± standard deviation. ANOVA was done using Smith's statistical package; *P* value < 0.05 indicates statistically significant difference. Study group obtained scores higher than test group in both heads of all three examinations.

the given time frame. Chakravarty et al.[15] have recommended assessment of anatomy in a problem-based medical curriculum at the Arabian Gulf University where problem-based curriculum has been implemented since 1982. They have used several methods to assess the different domains of learning, that is knowledge, skill and attitudes using multiple-choice questions, patient management problems and objective structured practical examination. They acknowledge that training should be based on 'applying processes of reasoning than by memorising of the facts'.

In our method, ICA is conducted on a limited portion covered in 1 week; hence a student can gauge his/her own performance vis-à-vis the efforts put in the dissection hall during the week. The students start taking active part in dissection. It gives the student an impetus to do better in the next test. The underachievers started asserting themselves. The student's efforts are guided by the desire to do well for which he/she is compelled to participate in every day's dissection. Outcome of each dissection was neat and better exposed structures. Each dissection becomes purposeful. The keenness to learn about the clinical aspect is the driving force to enter the dissection hall with enthusiasm and meet the learning objectives. The faculty was kept busy on this aspect. At There was a steady improvement in communication, more so in students from a vernacular background. The effort to structure the part examination in sets, that is identity, seek and show, demonstrate and explain, has yielded good response. It has prompted us to apply the same methodology for framing the questionnaire for other stations of practical examination, that is osteology, histology, living anatomy and radiology.

By following the methodology framed, we believe that the expected outcome would account for pruning the entire body dissection into the required number of compact dissection schedules. Since each schedule has specific learning objectives for the students, the students get focused. The outcome of each dissection is better and the condition of the part under dissection improves. The dissection hall is abuzz with animated discussion generated from genuine interest taken by the students. The sequential tests compel the students to be regular. This regularity and learning with a reason raises the comfort level of each student.

The credibility of these tests depends on the objectivity achieved and their bearing in the final assessment of the student. This necessitated designing the test for testing the comprehension rather than memorisation of the facts. The efforts put in to frame these structured tests have brought in objectivity and uniformity, a fact appreciated by the students who like questions to be asked to all the students from the same set. Hopefully, these tests when implemented at the university level would curtail the hither to practice where there is very little objectivity and uniformity and the students are at the whims and mercy of the examiner.

Conclusion

The threat to wreck havoc on the very edifice of medical education is to be countered by making dissection indispensable. It is to be achieved by following a planned strategy that makes the student realise the importance of dissection. To redeem the dissection, dissection schedules have to be compact and well defined in terms of practical steps and objectives. Frequent ICAs make each student actively participate in dissection and increase their curiosity and understanding culminating into better performance in examinations. Each ICA when structured under specific learning objectives provides students specific objectives in dissection classes. Over the years, each institution/university would modify, change and evolve a pattern that would bring in uniformity and objectivity in both conduction of dissection classes and assessments.

Abbreviations list

ICA, in-course assessment.

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