ORIGINAL ARTICLE

FOUR MONTH INTENSIVE TEACHING OF ANATOMY: AN ACCEPTABLE FOUNDATION FOR THE CLINICAL YEARS

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Background: This study was undertaken to determine whether medical students' recall of anatomy is lost when the student reaches clinical years, and whether a four month teaching of Anatomy in the pre-clinical years had any impact. **Methods:** A cross-sectional study, using a short answer type paper consisting of eight questions in anatomy was administered randomly to 5th, 6th and 7th year medical students at Oman Medical College, Sultanate of Oman. These questions were further sub-divided into reinforced clinically oriented gross anatomy questions and not-reinforced gross anatomy questions taken from the topics that were covered during the pre-clinical year. The reinforced questions were taken from topics taught by clinicians during the clinical rotations. **Results:** Review of the overall scores showed a sharp decline of anatomy recall one year after the anatomy course. Average scores for the students in years 6 and 7 (clinical years) for the reinforced questions were significantly higher than the not-reinforced questions. **Conclusion:** We conclude that there was a decline of anatomy recall taught in a four-month intensive teaching course during the pre-clinical years, however, adequate knowledge in anatomy has been stored in the memory and reinforcement during clinical exposure enhances memory recall.

Keywords: Four-month intensive teaching, recall of anatomy, reinforcement, medical students

J Ayub Med Coll Abbottabad 2014;26(4):501–5

INTRODUCTION

Clinical faculty often express dismay at medical students not being able to retain knowledge gained during the initial stages of their course particularly pertaining to anatomy. Traditionally medical education curriculum is designed to build on firm foundations laid in the early formative years at college. Students on the other hand, often perceive this knowledge as unnecessary, perhaps even too detailed, as it does not seem relevant to them at the time. Human anatomy has always played a pivotal role during these years on which further training is based. More recently, the medical curriculum at different universities have started pruning topics, and reducing hours, abandoning traditional methodologies such as live dissections in favour of more attractive IT alternatives.[1–6] Many authors while affirming the need for good and firm grounding in anatomy, understanding the attitude of students have stressed the role of integration thereby bringing in clinical relevance in addition to using of newer teaching modalities and technology as a means to retain knowledge.[7,8]

Even as one attempts to understand this issue it is clear that different teaching programs offered at medical schools, the world over, have taken into consideration their own culture and backgrounds in shaping their curricula. The objective, or end product, of every academic program being in ensuring a well-qualified and trained undergraduate doctor who would be expected to practice medicine safely and then progress on to higher specialization at the appropriate time.[9] Traditional teaching is by lectures; lecture based learning (LPL) (Cambridge and Oxford)[10], newer innovations have resulted in system-based teaching instead of subject-based teaching. System-based teaching does integrate the pre-clinical and clinical subjects by making the subject more interesting but runs the risk of diverting the focus from the primary objective of strong basic sciences to clinical examination. Problem based learning (PBL) was introduced by McMaster University, Canada, in which student cantered learning is in small groups.[11] They claim that long term learning and recall is much better as the student solves the problems on their own without spoon feeding. A meta-analysis on this reveals that graduates having gone through PBL education were no better in clinical knowledge than students from a lecture-based curriculum.[12]

Literature sites the loss of general knowledge rate to be 20–30%.[13] With many authors reporting that knowledge of basic sciences taught in the first or second years of medical school significantly reduce during the clinical years and that details of anatomy in particular are forgotten.[14,15] The term 'disuse atrophy' coined by Bethe in 1928 and Cole in 1932 describe the fate of basic science knowledge when students enter the wards[16,17], with Miller and Dornhorst noticing only a few students had enough knowledge of basic sciences when they started clinical work.[18,19] Blizard reported that students view basic sciences only for passing exams,

forgetting it and even ultimately practice medicine without much knowledge of anatomy.[20]

Oman Medical College is affiliated to West Virginia University School of Medicine, Morgantown, USA. The medical curriculum has a 3-year foundation course and a 4-year medical program. The foundation course consists of non-medical subjects English, physics, chemistry, mathematics, biostatistics, computer courses and medical subjects include biology, physiology, general anatomy, general histology, general embryology, microbiology, biochemistry, psychology. The preclinical subjects of Anatomy, Physiology and Neurobiology are taught in 4-month and 2-month blocks respectively in year 4, while para-clinical subjects of Pathology, Pharmacology, Microbiology and Public Health are taught in an integrated format in year 5. During block teaching only one major subject is taught at a time. Year 6 and 7 are the clinical years and the students rotate among the clinical subjects for a total of 14 weeks; 8 weeks block rotation in year 6 and 6 weeks block rotation in year 7.

It is with this background we hypothesize that the recall of anatomy following a four-month intensive teaching course in human gross anatomy in year 4 is significantly reduced during the clinical years.

MATERIAL AND METHODS

This is a cross-sectional study under taken at Oman Medical College (OMC), Sohar, Sultanate of Oman after Institutional Research Review Board (IRRB) approval. A mini-exam consisting of eight short answer questions was administered to students recruited from year 5, 6 and 7, in the middle of their academic year 2012–13 and without prior information.

Questions were developed following focused group discussions that the authors had with peers from the discipline of anatomy. There were 8 short answer questions of gross anatomy comprising of core knowledge of gross anatomy testing their knowledge of all the regions of body. Topics were chosen from previous examinations in the subject making sure that the questions tested core knowledge and that 50% of these questions were clinically relevant, being reinforced by clinical faculty during their clinical rotations. These clinically reinforced questions were shown to the clinical faculty (Medicine, Surgery, OBG) to ensure that the topics were taught to the students during their clinical rotations. Among the reinforced questions, there was one question on the thorax (heart valves), one from pelvis (uterus), and two from abdomen (common bile duct and anterior abdominal wall), among the questions which were not reinforced were from the musculoskeletal system (nerve injuries and movement of a joint) and pancreas.

This question paper was sent to five panels of Anatomists in reputed universities in USA, India, Saudi Arabia, Pakistan and Oman to confirm the level of knowledge and difficulty level of each question. Level of knowledge was classified into: core knowledge, desirable knowledge and nice to know knowledge, while the difficulty level was classified from 1-5; 1 being the easiest. After being peer reviewed it was agreed that all the questions tested core knowledge and were of the difficulty levels 1 and 2.

This mini-exam was administered in the presence of the principal investigator during their lecture hour at different times and students were asked to answer the questions individually in ten minutes without any consultation with each other or reference books.

Statistical analysis was done using Multivariate analysis of variance (MANOVA) and ANOVA to determine significant difference in scores (p=0.05) between years 5, 6 and 7 year students and between reinforced and not-reinforced anatomy questions.

RESULTS

A total of 142 students from years 5, 6 and 7 took part in this study after giving written consent. 17 were males and 125 females constituting 60–70% students in each year.

In year 5, the percentage of correct average scores was 42%. The percentage of average score for correct answers increased to 56% in year 6 and decreased to 50% in year 7. This was statistically significant between year 5 and 6 (p=002) (Figure-1).

The average percentage of correct scores of reinforced questions in year 5 was 40%, which increased significantly in the subsequent years. On analysis of the not-reinforced anatomy questions, average percentage of correct scores in year 5 was 25% which did not show significant change during the subsequent years. The difference between clinically reinforced and not-reinforced questions was statistically significant during year 6 and 7 (p=.001) (Figure-2).

Analysis of not-reinforced gross anatomy questions (Q. 1, 3, 4, 6), showed 20–30% correct answers given by all the three classes (Figure-3).There was no other statistically significant finding between the questions and the years.

Analysis of the reinforced gross anatomy questions (Q. 2,5,7,8) revealed 80–90% correct answer scores by year 6 and 7, with questions 5 and 8, correct answer scores showing from an average of 40% in year 5 to an average of 80% in year 6 and 7 (Figure-3).This was statistically significant (p=0.001).

Question 2, which was reinforced question showed high average score of 85% in year 5, 6 and 7. This topic was reinforced in the year 5 during the physical examination course in the clinical skill laboratory. Question 7, which was also a reinforced question, the average correct scores were 40% in years 5 and 6 which subsequently decreased to 35% in year 7.

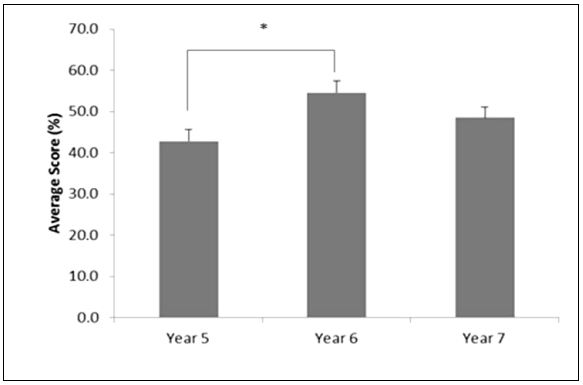

Figure-1: The graph showing the overall anatomy average scores in years 5, 6 and 7. Significant different between years 5 and 6 (*p*=.002).

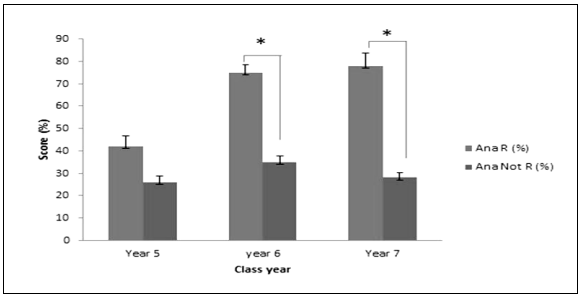

Figure-2: The graph showing average scores of reinforced and not-reinforced anatomy questions during years 5, 6 and 7. Significant difference between the average scores in year 6 and 7 (*p*=0.001).

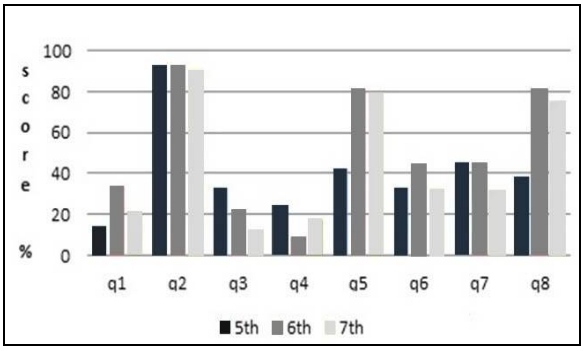

Figure-3: Average correct scores of individual questions in years 5, 6, and 7. Reinforced questions (2, 5, 7, 8) showing significant higher average scores than not-reinforced questions (1, 3, 4, 6).

DISCUSSION

To our knowledge, this is first such a study in the Sultanate of Oman on the recall of anatomy during para-clinical and clinical years.

The study showed that there was a sharp decline in the retention in the subject of anatomy (42%), one year after the anatomy block. Miller *et al* reported a mere 10% of retention of anatomy following the traditional 1st year course[18], Kennedy *et al* reported 83% retention after 2 years[14] and Blunt *et al*. reported 75% retention after 12 month (2nd year medical student) and 21 month period (3rd year medical students)[21]. Smaller decline in knowledge of Anatomy was also reported by Ling.[22] It is also reported that knowledge loss does not seem to be related to performance during the course and in the final examination.[23] DuBois *et al* reported 73% retention after 4-6 years.[24] Krebs discovered that medical students retained 65% of the simple basic science knowledge.[25] Overall, loss of knowledge reported is being 10-83%; Oman Medical College is within this range. This loss of memory recall with the passage of time is a universal fact which is more depended on subject than the way it is taught, however, repetition or reinforcement of a topic may prevent the disuse atrophy.

The overall memory recall of anatomy improves to 60% in year 6 which was not sustained in the year 7. Blizard and Blunt reported 75% retention for similar period.[20,21] A slight decline of anatomy recall may be due to the burden of impending exit examinations.

Analysis of reinforced clinically oriented gross anatomy and not-reinforced questions revealed that reinforced clinically relevant questions exhibited significant increase in the scores. This memory recall of anatomy improved during the clinical rotations from years 6–7, which clearly suggests that previously rehearsed topics in the clinical scenarios induced recall and improves retention of knowledge. The role of reinforcement by patient exposure and clinical faculty teaching as a method of memory recall and retention surpasses para-clinical exposure in the earlier year. Long term memory is engraved firmly by reinforcement.[26–29] Custers in his study stressed the need for reinforcement in anatomy and that clinical practice helps this process.[23] This is also supported by longitudinal data from five medical schools across the USA which confirms strong association with reinforcement and improved levels of performance in medical school and clinical competence during residency.[30]

On the other hand, analysis of not reinforced questions showed a decrease in memory recall from years 5–7 showing a trend of gradual decline of

anatomy knowledge from year 5–7. Based on the above findings, the following have been identified as possible contributing factors for retention of knowledge and memory recall:

A very important factor in terms of long term memory is reinforcement, which is observed in this study where there was only 10-20% loss of retention in the clinically reinforced questions 1–3 years after anatomy was taught

The above efficacy of reinforcement would not have been possible if the course for the basic 4 month intensive teaching of anatomy was un-adequate. In block teaching where one major subject is taught at a time, students focus on one subject and spend more time in the dissection hall hence get fully immersed in the subject. Some authors also reporting that spacing of the subjects significantly improves retention of knowledge.[27,31] The advantages of block system has been reported as short focused course, no distraction by other subjects, and the total duration in terms of hours for practical demonstrations on dissected specimen in anatomy are the same as in the full year traditional teaching.[32] This proves the fact that the human brain can retain a lot of information in a very short period of time as seen in the case of gross anatomy and, structured clinical reinforcement makes two years of anatomy teaching oblivious.

Integration of anatomy vertically with clinical subjects at an appropriate time is also reported to improve memory recall. In the USA and Canada, “back to basic sciences” program has been introduced by some universities where integration of basic sciences takes place in the clinical years.[33]

CONCLUSIONS

Our hypothesis that memory recall of gross anatomy during the clinical rotation is significantly reduced after 4-month block teaching was not supported by this study. This study shows that adequate knowledge in anatomy has been engraved in the memory and that reinforcement during clinical years enhances recall.

RECOMMENDATIONS

It is also recommended that suitable placed clinically relevant anatomy lectures during the clinical years would further reinforce gross anatomy and enhance the understanding of clinical topics hence improves the performance of the future doctor.

REFERENCES

1. Kamrin BA. The current status of anatomical teaching in selected medical schools. J Med Educ 1954;29:31–8
2. Older J. Anatomy: a must for teaching the next generation.Surg J R Coll Surg Edinb Irel 2004;2:79–90
3. Adam C. Student doctors skipping anatomy lessons. News, The Australian, March 31, 2010.
4. Sugand K, Abrahams P, Khurana A. The anatomy of anatomy: a review for its modernization. Anat Sci Educ 2010;3(2):83–93
5. Benjamin EM, Prince KJ, Drukker J, van der Vleuten CP, Scherpbier AJ. How much anatomy is enough? Anat Sci Educ 2008;1:184–8.
6. Craig S, Tait N, Boers D, McAndrew D. Review of Anatomy education in Australia and New Zealand medical schools. ANZ J Surg 2010;80(4):212–6
7. Prince KJ, Scherpbier AJ, van Mameren H, Drukker J, van der Vleuten CP. Do students have sufficient knowledge of clinical anatomy? Med Educ 2005;39:326–32
8. Waterston SW, Stewart IJ. Survey of clinicians' attitudes to the anatomical teaching and knowledge of medical students. Clin Anat 2005;18:380–4
9. D’Eon MF. Knowledge loss of medical students on first year basic science courses at the University of Saskatchewan. BMC Med Educ 2006;6:5
10. Turney BW. Anatomy in a modern medical curriculum. Ann R Coll Surg Eng 2007;89:104–7
11. http://en.wikipedia.org/wiki/Medical_school_in_the_United_Kingdom
12. Neville AJ. "Problem-based learning and medical education forty Years on". Med Princ Pract 2009;18(1):1–9
13. Vernon DT, Blake RL. Does problem-based learning work? A meta-analysis of evaluate research. Acad Med 1993;68:550–63
14. Kennedy WB, Kelley PR Jr, Saffran M. Use of NBME examinations to assess retention of basic science knowledge. J Med Educ 1981;56:167–73.
15. Norman G. The essential role of basic science in medical education: the perspective from psychology. Clin Invest Med 2000;23:47–51; discussion 52–4.
16. Bethe A. Kritische Betrachtungen uber den vorlinischen Unterricht. [Critical observation on pre-clinical education] Klinische Wochenschrift, 1928;7(31):1481-1483
17. Cole L. What is wrong with the medical curriculum? Lancet 1932;220 (8) :253–4
18. Miller GE, Graser HP, Abrahamson S, Harnack RS, Cohen IS, Land A. Teaching and learning in Medical School. Cambridge, MA: Harvard University Press, 1961: 59–60
19. Dornhorst AC, Hunter A. Fallacies in medical education. Lancet 1967;23(2):666–7
20. Blizard PJ, Carmody JJ, Holland RA. Medical students’ retention of knowledge of physics and biochemistry on entry to a course in physiology. Br J Med Educ 1975;9(4):249–54
21. Blunt MJ, Blizard PJ. Recall and retrieval of anatomical knowledge. Br J Med Educ 1975;9:252–63
22. Ling Y, Swanson DB, Holtzman K, Bucak SD. Retention of basic sciences information by senior medical students. Acad Med 2008;83:82–5
23. Custers EJ, Ten Cate OT. Very long-term retention of basic science knowledge in doctors after graduation. Med Educ 2011;45:422–30
24. DuBois AB, Nemir P Jr, Schumacher CF, Hubbard JP. Graduate medical education in basic sciences. J Med Educ 1969;44:1035–43
25. Krebs R, Hofer R, Bloch R, Guibert J-J. Conversation and forgetting of the biological knowledge at the propaedeutic exam [in French] 1994;4:10-5.
26. Bransford JD, Brown AL, Cocking RR, Editors: How people learn: Brain, mind, experience and school. Washington, DC: National Academy Press, 2000.
27. EL-bab MF, Sheikh B, Shalaby S, EL-Awady M, Allam A. Evaluation of basic medical sciences knowledge retention among medical students. Ibnosina J Med BS 2011;3:45–52
28. Halpern DF. Thought and knowledge: An introduction to critical thinking. Mahwah, NJ: Lawrence Erlbaum Associate, Inc. Publishers, 2003.

29. Rudland JR, Rennie SC. The determination of the relevance of basic science learning objectives to clinical practice using a questionnaire survey. Med Educ 2003;37:962-5
30. Gonnella JS, Hojat M, Erdmann JB, Veloski JJ. Assessment measures in medical school, residency, and practice: the connections. New York: Springer, 1993.
31. Kerfoot BP, DeWolf WC, Masser BA, Church PA, Federman DD. Spaced education improves the retention of clinical knowledge by medical students: a randomized controlled trial. Med Educ 2007;41:23–31
32. Ward PJ. First year medical students' approaches to study and their outcomes in a gross anatomy course. Clin Anat 2011;24:120–7
33. Spencer AL, Brosenitsch T, Levine AS, Kanter SL. Back to the basic sciences: An innovative approach to teaching senior medical students how best to integrate basic science and clinical medicine. Basic Sci Educ 2008;83:662–9

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