Journal of Anatomical Sciences

Email:anatomicaljournal@gmail.com

J Anat Sci 4 (2)

Evaluating the Continued Relevance of Dissection in Medical Education and Practice

Zagga A. D., Usman J. D., Bello A and Tadros A. A.

Department of Anatomy, College of Health Sciences,
Usmanu Danfodiyo University, Sokoto, Nigeria.

Corresponding Author: Dr. A. D. Zagga,
E mail:adauduzagga@gmail.com;adauduzagga@yahoo.com;
adauduzagga@udusok.edu.ng, Tel: +234 (0) 8035175780,

ABSTRACT

Today, there is a worldwide move of anatomy-based teaching away from dissection to prosection. Cadaver dissection is viewed as an occupation quite divorced from living human beings. Educators should be aware of the dramatic change of attitudes among students and the process of professionalization which might influence their caring of future patients. The art and science of medicine is defining the problem of a patient with as much precision as possible. Defining the anatomical site of the lesion is crucial if the physician is to resolve the problem effectively and compassionately. Therefore, a sound knowledge of anatomy is essential from the beginning of a medical education. This can only be achieved by exposing and examining the body, best revealed and studied by dissection. The value of the dissecting room in the medical school curriculum should be debated by the concerned stakeholders. The dominance of research should be revisited so that a balanced consideration is established with teaching. Dissection-based instruction is indispensable for the achievement of the goal of producing qualitative, active, caring, compassionate and reliable medical doctors and who are committed to patient care. The cadaver must not be dismissed as obsolete, for the patient is paramount. Computers should be used to enhance anatomical education and to assist the dissecting room, not to replace it.

Key words: *anatomy, dissection, compulsory, qualitative medical graduates.*

INTRODUCTION

Dissection of the human body is crucial for many medical preclinical courses in the traditional medical schools.[1] It is unique in distinguishing medical from non-medical students in biological sciences.[2] Teaching anatomy to both undergraduate medical students and medical graduates is in the midst of a downward spiral. 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structural anatomy taught by didactic lectures and complete dissection of the body with personal tuition, has been replaced by multiple range of special study modules, problem-based workshops, computers, plastic models and many other teaching tools. In some centres, dissected cadaver-based anatomy is no longer taught.[3]

Towards the end of the nineteenth century the deceased human was at the core of investigation and knowledge acquisition. Dissection-based anatomical analysis facilitated the classification of the bodily components, the development of a vocabulary for describing the body with clarity and precision and mapping the bodily organs and their surface projections, which would be later used in physical diagnosis. Clinical medicine was significantly enhanced by Sir William Osler's study of anatomy and pathology.[4]

A sound knowledge of anatomy is essential if the medical practitioner is going to accurately define and successfully treat the problem presented by the patient. The dissected cadaver remains the most powerful means of presenting and learning anatomy as a dynamic basis for solving problems. The cadaver must not be dismissed as obsolete. Dissection has survived the most rigorous test of pedagogical fitness – the test of time. The student-cadaver- patient encounter is paramount in medical education.[3]

Medicine is the compassionate solving of problems by the application of scientific knowledge. This is best achieved by the exposure and examination of the tissues and structures inside the body, and is best revealed by dissection. Biomedical informatics and sophisticated clinical imaging have only magnified our knowledge of structural organisation. They have not rendered the source of that information 'the cadaver-patient' obsolete. Educating medical undergraduates in the principles of anatomy has many facets: it introduces students to the reality of death; develops their manual dexterity; emphasises the concept of biological variation and demonstrates common pathologic changes; teaches the basic language of medicine; assists with social bonding and communication; and instructs how to assess information.[3]

THE NECESSITY FOR STUDENT-CADAVER ENCOUNTER

The student must come to grips with human mortality and morbidity. Of course the patient comes first and many argue that the cadaver is the first patient.[5] The student-cadaver encounter in medical education is the 'nodal point' – the moment in time between stopping and starting; from absolute convergence to comparative divergence.[6]

The first 'patient' is a dead one.[7] Dissecting a cadaver the student encounters the reality of life, morbidity and mortality, the awesome responsibility of the physician caring for the patient. It is better to begin with cadaver, the stillness reduces complexity and gives a better understanding of gross anatomy integrated to structure and function which can then be extrapolated to the living. Dissection puts undergraduates at the sharp end of medical education.[8] They may experience anxiety and stress not as a detachment or indifference but as a defence mechanism, often coming for the first time, connecting with reality and a detached concern. Common-sense and trust appear to suffice in most cases.[9] The 'nodal point' in medical education can lead to the compassionate detachment that is essential if a physician is to cope with issues involved in death and bereavement.[10]

A programme which endeavours to connect the student with reality teaches students to observe, conceptualise and test hypotheses.[11] The removal or attenuation of cadaver dissection is bound to impair the student's ability to apply the scientific method during diagnosis.[12]

THE POWER OF SENSATION OF TOUCH

The sensation of touch between physician and patient is essential. This is best learned early in the dissecting room.[13] Hands-on teaching on real cadavers is the first experience of the structural organisation of the body, both at the surface and in depth, and leads to a real understanding of the three-dimensional configuration of patients' anatomy. Three-dimensional high resolution virtual modalities are an inadequate substitute for the cadaver itself or its parts.[3]

Some of today's undergraduates have not dissected in biology classes at high school or even seen their teachers dissect. Experiments in physiology, biochemistry and pharmacology, using one's hands, have disappeared from the medical curriculum. The students no longer take blood, the phlebotomist does that. Human dissection is the one remaining educational modality that teaches students how to use their hands. This will help them to develop touch-based skills which can be transformed to palpation, percussion and auscultation.[13] Better to learn on a cadaver how to use instruments than to experiment on patients. The manual skills learnt in the dissecting room are essential in almost every branch of the medical profession.[3]

DETECTION AND APPRECIATION OF ANATOMICAL VARIATIONS

One of the most important concepts in medicine is biological variation.[14] No two individuals are necessarily the same anatomically. As students wander from one cadaver to the next in the dissecting room, they will see anatomical variation associated with developmental anomalies. It may reveal something new, previously unknown, and especially important in the rapidly evolving field of molecular developmental anatomy. Students will appreciate the actual complexity revealed by dissecting the whole – the concept of individuality. Human anatomical variation is common and often of clinical importance, especially in invasive surgical procedures such as hysterectomy and colectomy. The undergraduate will also learn for the first time the various surgical procedures seen in different cadavers, for example inserted pace makers, artificial joints and bypass vessels.[15]

Current trends in undergraduate courses involve reduced exposure to dissection and dissected specimens, increased use of plastic bones, models and computer-generated simplified images, which view the body as a fixed identical type or norm. Students must be prepared for unpredictable variations. These are best learned in the dissecting room laboratory, not with simplified computers or even prosections, although they can be used to enhance the variations seen in the dissecting laboratory. One of the consequences of poor over simplified undergraduate training is inadequate post-graduate knowledge, which will lead to misdiagnosis and even malpractice.[16]

ESTABLISHMENT OF COMMUNICATION SKILLS AND TOGETHERNESS

Actual cadaver dissection is essential for the acquisition of anatomical language.[17] For an accurate and precise diagnosis it is essential to have an anatomical vocabulary which clearly describes the anatomical science of the lesion or problem. Although computers can be used to decrease rote learning of facts and assist with problem solving, the more a physician remembers anatomical facts the better his clinical skills will be. He or she is able to think on their feet. This is especially necessary in emergency medicine. Attempting to memorise anatomical vocabulary watching a computer screen will leave the student "never sure of myself."[18]

Small group teaching around a cadaver in the dissecting room initiates the undergraduate to bonding with colleagues. He or she must learn to be a variable member of a team caring for sick people. Bonds developed early run deep and are never forgotten. As we *viva voce* young students on their dissections they learn to present facts and express themselves; invaluable practice in learning to put up a reasoned response and a good defence. For all too soon they will be quizzed thoroughly and even critically by their patients and relatives.[14]

EQUIPMENT USED FOR OBSERVATION

Powerful new instruments are now available to the diagnostician and surgeon, which the anatomist can use to observe the internal anatomy with astonishing precision. Computerised tomography (CT), magnetic resonance imaging (MRI) and ultrasound have all enhanced the importance of cross-sectional anatomy.[3] To some, these imaging modalities have transcended the cadaver as a learning tool.[19] Dissection is destructive rather than a

constructive process.[3] Some authors have suggested that it will be replaced by the cyber cadaver.[20] However, there is growing view that with the new imaging technology and endoscopic procedures, the diagnostician as well as the surgeon must appreciate accurate cross-section anatomy and topographical anatomical relationships, which only dissection can provide.[21] Dissection of the cadaver will help master the vocabulary and topography at the beginning of studies.[3]

COMPUTER-BASED/ASSISTED TEACHING AND LEARNING

Computer-based learning was said to benefit problem solving workshops and facilitated the integration of basic and clinical science. The merit of computer is not disputed or contested. The debate is to identify its proper use in educating the medical student. Computers do not replace brain power in handling information and making decisions.[3]

Excessive exuberance over cybernetic technology has devalued the deceased human in medical education. The computer may be a supplement but does not replace the human brain. High technology tends to dehumanise patient care, a growing rejection both of patients and physicians.[3]

Medicine is a direct dialogue between the patient and physician. Sophisticated technology can test and establish the diagnosis at the interface but must not abuse the relationship between patient and healer.[3] The dissected cadaver remains the most powerful means of presenting and learning anatomy as a dynamic basis for solving problems. Anatomy involves the integration of form and formation. If students only use models, images, audiovisuals or computers they will not develop the requisite reasoning that comes from investigative dissection of real tissue in acquiring knowledge of the living.[22]

DISSECTION AND POSTGRADUATE SURGICAL TRAINING

A solid grounding in basic science, especially anatomy dissection, provides an invaluable foundation for a successful surgical career. The Surgical Fellowship until recently, was a broad-based examination taken early in training. The initial Primary examination had a high standard in basic sciences, a very testing component with essay questions and vigorous *vivas.* A fundamental requirement was an intimate knowledge of anatomy.[3]

Between 1995 and 2000 there was a sevenfold increase in claims associated with anatomical errors submitted to the United Kingdom (UK) Medical Defence Union. It is distressing that it may require several cases of major litigation before some educationalists, administrators and surgeons wake up and acknowledge the lack of anatomy in the new generation of surgeons operating on patients.[23] Cahill *et al.* have expressed concern that of 80,000 avoidable deaths per year in the United States, at least some can be attributed to anatomical incompetence.[18] Oliver Beahrs, an internationally acclaimed surgeon from the Mayo Clinic, and the first President of the American Association of Clinical Anatomists puts this more bluntly - "... today's residents in surgery are learning their anatomy on sick patients for the first time in the middle of the night; operating without a firm knowledge of anatomy leads to increased mortality and morbidity."[24] Is it not regrettable that we have in perpetuity set up a system that is allowing young men and women with a poor knowledge of anatomy to become surgeonsΔ[3]

Postgraduate surgical training must also be seen in the light of changes implemented in medical schools. Discipline based departments have been reorganised into larger units of biomedical science with divisions. This has resulted in a reduction of time allocated to anatomy, particularly dissection by students. The development of integrated courses with multidisciplinary examinations in which poor performance in anatomy is compensated for by good marks in other subjects. There is a decline in faculty staff with expertise in human anatomy and corresponding enthusiasm for teaching it, and fewer demonstrators. These factors leave today's medical graduates who are embarking on surgical training programmes with a poor knowledge of anatomy.[3]

Older (2004), expressed that surgical trainees are now expected to be taught anatomy at the operating table through the "window" of the operation. As described by Beahrs (1991) this window of anatomical learning is to be deplored.[21,25] Their higher surgical training will be based on shifting sand rather than solid rock.[24] The surgical trainee must be taught the basic science relevant to his chosen surgery. Surgeons have less knowledge of anatomy of the whole body and retain only knowledge of the specialist region in which they operate and work.[25] Specialist surgeons will have to shoulder the burden of teaching specialist anatomy to their trainees.[26]

In an assessment of undergraduate medical students, there was a 94% response (340 of 361 students) to a short questionnaire. The majority of students enjoyed being taught by trainees and found the clinical relevance invaluable. Ninety eight per cent of the students would prefer to continue formal dissection instead of the new computer-assisted learning course.[27]

GAUGING THE SIGNIFICANCE OF DISSECTION IN THE MEDICAL TRAINING

Several surveys were undertaken to assess the significance of gross anatomy and especially dissection in medical training. In Germany, Pabst and Roth Kotter (1997), in a retrospective evaluation of undergraduate medical education by doctors at the end of their residency time in hospitals, found 90% of the doctors considered gross anatomy essential and 6% necessary.[28] This review also showed, as have many others, that not only surgeons and consultants in diagnostic specialities but also physicians in general medicine and paediatricians graded anatomy high in clinical relevance. Another common feature of many reviews is that three-quarters of undergraduates asked for specialised dissection courses during their later clinical phase. A survey by Cottam (1999) in the United States showed that a majority of the residency programmes reported that gross anatomy was

either extremely or very important for residents to master and ranked it as the most important basic science.[29]

In Nigeria, Moji *et al.* (1992), reported from the University of Ibadan, on the factors influencing academic performance of medical students in the basic medical sciences that the students gained most from lectures while tutorials were rated as being more helpful than practical classes.[30] They argued that in anatomy, demonstrations on prosected specimens may well be more helpful than the actual dissection. However, this argument is opposed by many studies. Nwoha (1992) from the Obafemi Awolowo University, Ile-Ife, Nigeria, surveyed the student's attitude and predictor of performance in anatomy. He reported that performance in practical anatomy dissection had significant positive correlation with performance at the second year examination in anatomy.[31]

In Singapore, 75% of medical students in all five years of their course found gross anatomy clinically relevant and 89% considered dissection helpful or very helpful in their understanding of gross anatomy. When asked whether dissection should be replaced by demonstrations in prosected specimens, 87% gave a resounding "no."[32] Graduates at McMaster, Ontario, Canada considered insufficient attention was paid to basic science in general and anatomy in particular in the McMaster curriculum.[33] Many workers have registered concern that the amount of detail in gross regional anatomy has decreased below safety levels.[34,35]

A study by Johnson (2002), comparing personal dissection versus peer teaching of upper and lower extremities in Virginia USA, has shown that although peer teaching was generally successful, first year medical students preferred to dissect for themselves. The results are consistent with the contention that hands-on dissection enhance learning and confidence in the subject matter.[36] Many investigators have compared the performance of students who dissected, with students who studied prosected specimens. Some have found no significant difference.[37,38] Other studies indicated that although learning from prosections was not a serious disadvantage, there was a small but significant difference in favour of personal dissection.[39-41]
Snelling *et al.* (2003), reported, from the Guy's, King's and St. Thomas'(GKT) School of Biomedical Science (UK), on the attitudes towards dissection of 474 first year medical and dental students. In this study, students benefited from active practical dissection before a prosection-based tutorial on the subject. Active dissection remains popular with the students.[42]

In a recent study by Zagga *et al.* (2010), on the attitude of preclinical medical students towards anatomical dissection of cadaver in Usmanu Danfodiyo University, Sokoto, Nigeria, male students liked dissection and appreciated that its importance could not be overemphasized in aiding the understanding of the anatomy subject, than their female counterparts.[43]

FUNDING

The dissecting room is an extremely expensive area in any Department of Anatomy in a Medical school. It has a very extensive floor space, which now has to compete with molecular biologists with enormous research grants clambering for more research laboratories. Many Universities have not been able to afford or are not prepared to cover the cost of upgrading ventilation in the dissecting room to bring it up to the required standards.[44] Cadavers are expensive, involving initial transportation and preparation, large space for storage and finally disposal, burial or cremation.[14] To obey every aspect of Anatomy Act and respect those bodies is much more expensive than a few computers. The financial resources of institution are primarily directed to secure patient income and funding for research.[18] Educating both under- and post-graduate students is inevitably at the end of the queue in terms of economic stringency. The designers of a new curriculum, hiding behind "keeping pace with the times" say "close the dissecting room," reduce staff and their salaries while the student numbers increase. But the staffing needs of a department in terms of numbers, preparation and finances are greater both for prosection-based and small group computer imaging-based courses than the traditional dissecting-based course. Dissecting room teachers are unpopular with administrators, who rarely, if ever, come into the dissecting room to see and talk with students and teachers.[14]

CONCLUSION

Dissection-based instruction is indispensable for the achievement of the goal of producing qualitative, active, caring, compassionate and reliable medical doctors who are committed to patient care. The cadaver must not be dismissed as obsolete, for the patient is paramount. Computers should be used to enhance anatomical education and to assist the dissecting room, not to replace it.

REFERENCES

1. Nnodim JO. Learning human anatomy: by dissection or prosection*Med Educ.*1990; **24**: 389-395.
2. Firth J. Levels and sources of stress in medical students. *BMJ.* 1986; **292**: 1177-1180.
3. Older J. Anatomy: A must for teaching the next generation. *Surg J R Coll Surg Edinb Irel.* 2004; **2**: (2) 79-90.
4. Bliss M Osler W. *A life in Medicine* Oxford University Press; New York. 1991.
5. Peabody FW. The case of the patient. *JAMA*. 1927; **88**: 877-882.
6. Pelliigrino ED. Educating the humanist physician: An ancient ideal reconsidered. *JAMA*. 1974; **277**: 1288-1294.
7. Bertman SL Marks SC Jnr. Humanities in medical education: Rationale and resources for the dissection laboratory. *Med Educ*. 1985; **19**: 374-381.
8. Maguire P. Barriers to psychological care of the dying. *Br Med J*. 1985; **291**: 1711-1713.
9. Dinsmore CE Daugherty S Zeity J. Student responses to the gross anatomy laboratory in medical curriculum. *Clin Anat*. 2001; **14**: 231-236.
10. Evans EJ Fitzgibbon GH. The dissecting room:

Reaction of first year medical students. *Clin Anat*. 1992; **5**; 311-320.
11. Pabst R Westerman J Lipper H. Integration of clinical problems in teaching gross anatomy. *Anat Rec*. 1986; **215**: 92-94.
12. Aziz MA McKenzie JC. The dead can still teach the living: The status of cadaver-based anatomy in the age of electronic media. *Perspect Biol Med*. 1999; **42**: 402-421.
13. Moore NA. To dissect or not to dissectΔ *Anat Rec (New Anat)*. 1998; **253**: 8-9.
14. Ellis H. Teaching in the dissection room. *Clin Anat*. 2001; **14**: 149-151.
15. Cahill DR Leonard RJ Weiglein AH von Lüdinghausen. View point: unrecognised values of dissection considered. *Surg Radiol Anat*. 2002; **24**: 137-139.
16. Willan PLT Humpherson JR. Concepts of variation and normality in morphology. Important issues at risk in modern undergraduate medical courses. *Clin Anat*. 1999; **12**: 186-190.
17. Keller H. *The story of my life*. 1990; New York: Bantram Books.
18. Cahill DR Leonard RJ Marks SC Jnr. Standards in healthcare and medical education. *Clin Anat*. 2000; **13**: 150.
19. Spitzer VM Whitlock DG. The visible human dataset: The anatomical platform for human simulation. *Anat Rec (New Anat)*. 1998a; **253**: 49-57.
20. Rosse C. Terminologia anatomica considered from the perspective of next generation knowledge sources. *Clin Anat.* 2001; **14**: 120-133.
21. Beahers OH. Gross anatomy in medicine. *Clin Anat*. 1991; **4**: 310-312.
22. Miller SA Perroti W Silverthorn DU Dalley AF Rarey KE. From college to clinic: reasoning over memorisation is key for understanding anatomy. *Anatomical Record*. 2002; **269**(2): 69-80.
23. Ellis H. Medico-legal litigation and its links with surgical anatomy. *Surgery* 2002:
24. Green NA. Anatomy training for surgeons: Letter. *J R Coll Surg Edinb.* 1999; **43**(1): 69-70.
25. Raftery AT. Basic surgical training. Postgraduate surgical examinations in the UK and Ireland. *Clin Anat* 1996; **9**: 163-166.
26. MacIntyre ICM. Anatomy training for surgeons. *J R Coll Surg Edinb* 1998; **43**: 71.
27. Gossage JA Horner B Halsey T Ellis H. *How will the loss of the Anatomy Demonstrating Posts affect the medical student and surgical trainee. Clin Anat*; in press
28. Pabst R Rothkotter HJ. Retrospective evaluation of undergraduate medical education by doctors at the end of their residency time in hospitals: Consequences for the anatomical curriculum. *Anatomical Record* 1997; **249(4)**: 431-434.
29. Cottam WW. Adequacy of medical school gross anatomy education as perceived by certain postgraduate residency programs and anatomy course directors. *Clin Anat* 1999; **12(1)**: 55-65.
30. Moji O Fasamande AA Oyebola, DDO. Factors influencing academic achievement of medical students in the basic medical sciences. *African Journal of Medicine and medical Sciences.* 1992; **21**: 29-34.
31. Nwoha PU. Student's attitude and predictor of performance in anatomy. *African Journal of Medicine and medical Sciences.* 1992; **21**: 41-45.
32. Leong SK. Back to basics. *Clin Anat* 1999; **12(6)**: 422-426.
33. Woodward CA Ferrier BM. The content of the medical curriculum at McMaster University: graduates' evaluation of their preparation for postgraduate training. *Med Educ* 1983; **17:** 54-60.
34. Sinclair D. The two anatomies. *Lancet* 1975; **1**: 875-878.
35. Aziz MA McKenzie JC Wilson JS Cowie RJ Ayeni SA Dunn BK. The human cadaver in the age of biomedical informatics. *The Anatomical Record* 2002; **269**: 20- 32.
36. Johnson JH. Importance of dissection in learning anatomy: personal versus peer teaching. *Clin Anat* 2002; **15**: 38-44.
37. Alexander J. Dissection vs prosection in the teaching of anatomy. *J Med Educ* 1970; **45**: 600-606.
38. Nnodim JO Ohanaka EC Osuji CU. A follow-up comparative study of two modes of learning human anatomy by dissection and from prosections. *Clin Anat* 1996; **9**: 258-262.
39. Yeager VL. Learning gross anatomy: dissection and prosection. *Clin Anat* 1996; **9**: 57-59.
40. Wilson JT Tarby TJ Seale RU Whitlock DG. The two-course system in gross anatomy. *J Med Educ* 1975; **50**: 788-796.
41. Dinsmore CE Daugherty S Zeitz HJ. Teaching and learning gross anatomy: dissection, prosection or "both of the aboveΔ" *Clin Anat* 1999; **12 (2)**: 110-114.
42. Snelling J Sahai A Ellis H. Attitudes of medical and dental students to dissection *Clin Anat* 2003; **16**: 165-172.
43. Zagga AD Tadros AA Bello SM Bello A Usman JD. Attitude of Preclinical Medical Students towards Anatomical Dissection of Cadaver in Usmanu Danfodiyo University, Sokoto, Nigeria. *Journal of Sociology, Psychology and Anthropology in Practice: International Perspective* 2010; Vol. 2, Nos. 1-3; 69-74.
44. Kaufman MH. Anatomy training for surgeons – a personal viewpoint. *J R Coll Edinb*. 1997; **42**(A): 215-216.