

The State of Human Anatomy Teaching in the Medical Schools of Gulf Cooperation Council Countries

Present and future perspectives

"Anatomy is a science and it owes it to the practice".... Anon.

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تدريس مادة التشريح البشري في كليات الطب بدول مجلس التعاون الخليجي نظرة تفحص في الوضع الراهن وأمل للمستقبل

عُمر الحَبَّال

المُلخَص: هناك ظاهرة متنامية في طرق تدريس مناهج مادة التشريح . كما يتضح مما هو متوقَّع من مراجع في مجال التعليم الطبي . ففي العقد الماضي . وبمساندة مستجدات عصر المعلوماتية . حصل حَوَّل جوهريّ في طرق التعليم الطبيّ . فبالنتيجة . أصبح تشريح الجثة ضرباً من الماضي . وبالطبع انعكس هذا الحال على تدريس المادة في كليات الطب بدول مجلس التعاون الخليجي . لذا يهتم هذا المقال بالوضع الراهن لممارسات طرق التدريس التقليدي والمرتكز على الدروس العملية كطريقة لكسب العلم والمهارات . في مقابل الطرق المستحدثة التي تركز على وسائل التقنية الحديثة . كالتوضيح الإلكتروني والجسمات البلاستيكية . فالطريقة الحديثة تنغاضى عن فكرة الدراسة المرتكزة حول الجثة كوحدة بناء علمية أساسية لأطباء وجراحي المستقبل . وإن الخبرة الطبية العملية والحكيمة يمكن أن تنمي هذه المهارات الضرورية المكتسبة بعكس ما هو مطروح في مقررات التشريح المستحدثة.

مفتاح الكلمات: تعليم التشريح . التعلم بمساعدة الحاسوب . المناهج . جثة . تشريح.

ABSTRACT Available literature on medical education charts an emerging trend in the field of anatomy. In the past decade, assisted by innovations in informatics and the paradigm shift in medical education, the hands-on experience of cadaver dissection has progressively become a relic of the past. Within the context of the situation in Gulf Cooperation Council countries, this paper compares the traditional teaching approach with the modern one that tends to emphasise technical gadgetry, virtual reality and plastic models rather than hands-on-experience to impart knowledge and skill. However, cadaver-based learning is an important building block for the future physician and surgeon since clinical astuteness is likely to rely on skills gained from hands-on experience rather than the tendency to learning through virtual reality found in modern curricula.

Key Words: Anatomy teaching; Computer-assisted learning; Curriculum; Cadaver; Dissection.

TEACHING ANATOMY AS A MEDICAL AND clinical science is in a downward spiral. In the past, anatomical skills and knowledge were gained through didactic lectures and complete dissection of the body via personal tuition. This approach has been modernised by the addition of special study modules, problem-based workshops, computers,

plastic models and other teaching tools. Evidence suggests that, in some centres, dissected cadaver-based anatomy is no longer a priority. The present trend is likely to undermine the vital role of anatomy in life sciences and medical practice.

The report entitled "Tomorrow's Doctors"¹ published by the UK General Medical Council attempted

to address overcrowding of the undergraduate medical curriculum. It recommended a reduction of factual content across the curriculum yet failed to define what constitutes a “core curriculum”.¹ By allowing each institution to define its own core material and optional study modules, it paradoxically encouraged the establishment of a variety of curricula, but their suitability has not been scrutinised since there is no benchmark for comparability.² In Gulf Cooperation Council (GCC) medical schools, there is no unified approach to teaching medicine in general and anatomy in particular. The reduction in the content, depth and breadth of teaching and knowledge of anatomy; changes in basic surgical training; less new graduates adopting anatomy teaching careers, and a change in examination standards, are leading to a likely dire situation where tomorrow’s surgeons and physicians will lack a detailed knowledge of anatomy and have potentially questionable professional capability.³

A primary concern in cadaver-based learning is the difficulty in acquiring enough cadavers. Most, if not all, GCC countries do not have a body donor programme so unclaimed bodies are the main source for anatomical dissection. The use of cadavers in human anatomy teaching requires close supervision of students, but there is a worldwide shortage of qualified anatomists. Compared to other basic sciences, anatomy teachers have a higher teaching load and, given the current emphasis on research for career development, not surprisingly few graduates choose a career in anatomy. This negatively impacts on basic medical education.

Teaching the principles of anatomy within the dissecting room introduces students to the reality of death. It also emphasises the concept of biological variation and demonstrates common pathologic changes. With its rich vocabulary, it teaches the basic language of medicine. It also develops manual dexterity. Finally, it nurtures the group spirit thus assisting in social bonding and communication.⁴

The art and science of medicine is to define disease with concision and precision in order to decide on interventions. Adequate skills and knowledge of anatomy are therefore indispensable and should be imparted from the onset of medical education.⁵ The most appropriate method is to show the inner workings of tissues and structures of the human anatomy. However, major criticisms are levelled at anatomy teaching: overcrowded curricula packed with clinically unconnected facts; excessive memorisation; didactic

lectures; passive learning and lack of communication with patients. At the same time, computerisation and biomedical informatics have reduced the need for excessive memorisation and actual dissection.

This trend has significantly reduced the amount of time students spend learning anatomy.² In some centres, cadaver-based anatomy is no longer featured in the curriculum regardless of its vocational importance to physicians and surgeons.⁶ The present fashion to use clinical imaging to help conceptualise anatomical structures, effectively transforms anatomy into a different entity. The new trend is further facilitated with technologies like ultrasound, 3D visualisation, multiplanar computerised image reconstruction, multiplanar magnetic resonance imaging and plastinated prosections.⁷ Running counter to this revolution, some centres are now reverting to classical dissection.

Medicine is the compassionate art of healing through a detailed understanding of the tissues and structures inside the body, and this is best learnt by dissection.⁷ Although biomedical informatics and new imaging technologies have improved our understanding of anatomic structural organisation, the burning question is still: “is cadaver-based learning in the dissecting room relevant or essential for tomorrow’s doctor?” The answer to this question is addressed in the following discussion.

THE KEY ISSUE - LIFE AND DEATH

Some argue that anatomy, as a basic science, lacks connectivity with the living patient; however, changes in the field tend only to embrace the ‘living’ patient thus discounting mortality. Many argue that the cadaver is the first patient,⁸ the moment where students have to face the reality of life, morbidity and mortality and the awesome responsibility of a physician in caring for the patient. Beginning with a lifeless cadaver also reduces complexity, giving a good understanding of gross anatomy integrated to structure and function which can then be extrapolated to the living.

In the dissection room, the students learn skills by vicarious means. They may experience anxiety and stress, not through detachment or indifference, but as a defence mechanism. This should lead to the compassionate detachment essential for a physician to cope well with death, loss and grief.

Good medical education involves development of observation, conceptualisation and the formulation of hypotheses in order to produce critical thinking in

tomorrow's doctors. Curricula that demean the importance of dissection are likely to reduce the ability to approach diagnosis and intervention scientifically. This goes against the claims that current reforms are in line with evidence-based medicine.^{9,10}

MANUAL DEXTERITY

From the Hippocratic tradition, 'touch' between physician and patient has always been deemed an essential skill acquired in the dissecting room. Hands-on cadaver teaching is the first step towards deciphering the three-dimensional structural organisation of the body.¹¹ Even three-dimensional high resolution software, which appears better at visualising human anatomy, still produces a simplistic and distorted picture of the human body.¹²

Amidst the flurry of curricular reforms, students of medicine, and other basic science courses which are also divorcing human touch, have been left with no access to dissection,¹³ thus mortgaging their future to the whim of technological innovation. This could explain why tomorrow's doctors are often not even equipped to extract blood. Hands-on experience is important for developing the touch-based skills of palpation, percussion and auscultation which can be superior to the new mechanical gadgets. Hand dexterity, trained in the dissecting room, is part and parcel of all branches of the medical profession.

ANATOMICAL VARIATION

Biological variation is one of the most important concepts in modern medicine. Even a layman knows that no two individuals have identical anatomy and pathoanatomy. As students get exposure to different cadavers, they learn the principles of both anatomical variations and developmental anomalies. Thus, the future doctor is likely to acknowledge the complexity and uniqueness of the whole body. This realisation is essential when a doctor is confronted with amorphous clinical entities such as where to localise a hysterectomy or colectomy, and where and how to insert a pacemaker, an artificial joint or a bypass vessel.

Unfortunately, reduced student exposure to dissection and dissected specimens,¹⁴ and anatomy teaching using a computerised and standardised 'visible man',¹⁵ plastic bones, models and computer-generated simplified images will compromise future doctors' clinical astuteness - a recipe for misdiagnosis and eventual malpractice.¹⁶

TEAM SPIRIT

Although the new information age that is fuelled by fast computers has reduced 'rote learning', cognitive skills in anatomical concepts have direct relevance to clinical skills.¹⁶ The ability to call on these skills is essential for emergency medicine where, at the spur of the moment, one is required to make a clinical decision that entails life or death, litigation or job satisfaction.

Group activity is often an inherent feature of the traditional dissection room. In psychological parlance, people working for a common good are likely to benefit from group cohesion and the team-spirit of colleagues.¹⁷

DIAGNOSTIC INNOVATIONS

Powerful tools such as computerised tomography (CT), magnetic resonance imaging (MRI) and ultrasound have been developed to assist diagnosticians and surgeons as well as serving the interests of anatomy. There is even a growing hype that one day anatomy will be taught via the 'cyber cadaver'.¹⁸ However, it is clinical astuteness, owing it strength to hands-on experience, that produces highly skilled physicians and surgeons.¹⁹ Dissection of the cadaver should induct one into topography at the beginning of studies, with the new technology serving to consolidate knowledge. A balance between new and old methodologies can be found in some centres where anatomy is taught both by classic dissections and modern imaging technology.

COMPUTER-ASSISTED LEARNING

In less than two decades, medicine has witnessed a huge expansion of databases on the cellular and molecular processes of both healthy and diseased states. The instantaneous access, storage, and retrieval of information and hypertext on computers has also reduced the importance of rote learning, while computer-assisted learning is rewarding for problem solving workshops and indeed enhances the integration of basic and clinical sciences. However, our over-dependence on 'cybernetic' technology has devalued 'humanness' in medical education; machines cannot tell us anything about life or death. According to Older,¹⁷ "High technology tends to dehumanise patient care, with a growing rejection by both patients and physicians". We have yet to be convinced of the effectiveness of 'computer atlases' marketed as innovative anatomy teaching. The

dissected cadaver remains the most powerful means of presenting and learning anatomy as a dynamic basis for solving problems. Medicine is a direct dialogue between the patient and physician; therefore, if students only use models, images, audiovisuals or computers, they will not develop the requisite reasoning that comes from investigative dissection of real tissue to acquire knowledge of the living. Nor will they have the ability in emergencies to make clinical decisions that entail life or death, litigation or job satisfaction. Cognitive ability garnered with hands-on experience is paramount.

FINANCIAL IMPLICATIONS

Where institutions focus their expenditure on securing patient service income and funding for research, education lies at the end of the budget queue. There is a temptation among stakeholders to reduce staff and costs and 'keep pace with the times' by closing the dissecting room. Paradoxically, such a proposal is often mooted just when the number of students is rising.²⁰

POSTGRADUATE SURGICAL TRAINING

Changes in undergraduate medical education have partly influenced new trends in postgraduate surgical training. For example, a surgical fellowship was taken to mean a broad-based examination taken early in training with high standards in basic sciences, a very testing component with essay questions and vigorous *vivas*. The principle prerequisite was a proficiency in the art and science of anatomy. Thereafter, successful candidates became Fellows of a Royal College and then sought apprenticeship to sharpen their skills and knowledge. During apprenticeship, the qualified candidates were subjected to no further examinations. By the time they became senior registrars, their skills were second to none.²¹

However, times have changed with now a membership as an entry examination. Essays have been duly replaced by multiple choice computer-marked examinations. This form of assessing skills is a recipe for superficial learning. The *viva* is now often cursory. In some colleges, there are no prosections or models for surface anatomy. This means that some candidates now have an inferior knowledge of anatomy. Although empirical evidence suggests otherwise, the argument goes that a high standard of anatomy will be required at the Specialist Fellowship exit examination. How-

ever, it is unacceptable that young men and women with lack of skills and knowledge of anatomy are recruited for careers as surgeons. The new Membership and Fellowship examination system was supposed to maintain the previous high standards; however, it is becoming increasingly clear that such ambitions have failed to materialise.¹⁷

A background in basic science was previously required as foundation for a successful surgical career. The Calman report²¹ appears to have had a serious impact on the recruitment of surgical trainees to 'anatomy demonstrator' posts. This has triggered a 'domino effect' in anatomy departments which can no longer rely on surgical trainees to teach which, in turn, has adversely affected the ability of medical schools to deliver essential skills in anatomy.²¹

PROBLEM-BASED LEARNING

The present trend in anatomy curricula is to include integrated problem-based learning (PBL) and computer assisted teaching leading to a reduction in overall content, didactic lectures and mechanical rote memorisation.²² PBL is credited with heightening and synthesising students' knowledge of their respective field both in horizontal and vertical integration of different disciplines. In theory, using clinical vignettes, students learn to merge the clinical side with the underlying basic science concepts. However, studies at the University of Maastricht in the Netherlands have suggested that PBL tends to leave many students dissatisfied with their basic science knowledge, particularly in gross anatomy. During clinical clerkships they expressed a need for more anatomy training.^{23, 24, 25}

In one of the latest twists and turns on PBL, the Maastricht group have reported a longitudinal study of fourth year medical students at eight medical schools in the Netherlands to find out how PBL and non-PBL teaching methodology was perceived at the start of clinical clerkships. The results showed no significant difference in anatomy knowledge levels between PBL and non-PBL schools. However, the two centres which scored significantly higher in knowledge appeared to adhere to more traditional teaching methods.⁹ There is evidence that the repetition of topics has a beneficial effect, confirming a fundamental thesis of rote learning. Also, there is a discrepancy between what students think they know and what they think they need to know. On the whole, the integrated PBL approach seems to be associated with uncertainty and perceived

deficiencies in basic science.

TEACHERS OR RESEARCHERS?

Some anatomists have total control over teaching content, and methods, but increasingly these are beyond the control of anatomy teaching staff.⁶ Undergraduate programmes are now almost of footnote importance with survival strongly depending on research and the income it generates. Amazingly, dedicated career teachers are still to be found taking the teaching load off those more inclined to research. There is a perception that teaching, both basic science and clinical, is less academically valuable. In addition, there is a tendency to offer unattractive salaries to those with clinical qualifications,²⁶ and not to recruit gross anatomists for core teaching.²⁷ Most non-medical anatomists cannot build the bridge between basic science and clinical applications; this therefore calls for the reintroduction of medically qualified anatomists to classrooms. Some centres have thus recruited retired or semi-retired clinicians or surgeons to teach.

ANATOMY CURRICULA

In many GCC countries, the primary goals of teaching anatomy have not been empirically scrutinised before changing the undergraduate programme. For instance, little is known about how to implement a common core curriculum. Despite objections in this part of the world and elsewhere, there was no published data on the impact of the General Medical Council's 'Tomorrow's Doctors' report on anatomy teaching.¹ In the absence of comparative research and an agreed regional, let alone national, core curriculum, a variety of new curricula have been introduced over the past few years. There is no common medical licensing examination in the GCC, so medical schools are free to teach anatomy and to assess content and quality as they see fit, independent of external validation. As a result, anatomy teaching is at risk.

If the aim is to produce high calibre, caring and compassionate medical practitioners, then abandoning well designed cadaver-based instruction is contrary to achieving such goals. Jones et al. have challenged anatomists to gather hard evidence to support the importance of dissection;¹⁵ however, its pedagogical merit has passed the test of time. Judicious use of dissection, lectures, small group discussion, case studies and living anatomy can be linked with the computer and diagnostic imaging, involving human to human

and human to machine interactions, to create an enhanced learning environment. In the present climate of curricular reform, problem-based and system orientated studies, together with gross anatomy, must show affinity and creativity.

The debate is raging as to whether PBL will spread rapidly in medical schools or not.²⁸ In PBL there are no common themes and approach to teaching medicine, and gross anatomy in particular.²⁹ Some curricula do not include exposure to dissection, but rather just computers and models, meaning that medical students are not exposed to the 'real thing' until they enter clinical years under the pretext that "traditional anatomy teaching has negative predictive validity".³⁰ Smithers, well known for his medical education research, has suggested that PBL is a debunked educational school of thought from which children's schools in the UK are only just being salvaged by literacy and numeracy strategies. He has expressed surprise that medicine "which has at its heart a thorough and detailed understanding of the human body", should have taken up a method that has failed so spectacularly elsewhere.²⁸

CHALLENGES & OPPORTUNITIES

At this juncture, reflection is needed on the failures and successes of anatomy curricula and how to teach the principles of anatomy to tomorrow's doctors in order to develop their clinical skills. In the nutshell, is the dissecting room a relic of the past or inspiration for the future?

Some of the dissenting challenges that have to be faced are that:

- a. Anatomy is said to be an exhausted science.
- b. Dissection-based learning is increasingly less popular.
- c. The contents taught in anatomy are ill-defined.
- d. The insecurity of cadaveric resources make it risky to maintain cadaver-based teaching. This shortage reinforces the need to take advantage of new technologies and communications.
- e. Teaching methodology and the goals of learning anatomy are discrepant. In many departments, with lecture-based teaching and many hours of dissection, the excessive content prevents students from discerning between what is essential and what is accessory in clinical practice.
- f. Finally, the professional situation of anatomists

has been devalued. Given their often non-medical training background and promotion expectations, anatomy teachers can give more importance to research than to teaching.³¹

Reduction in anatomy instruction currently causes problems for medical professionals when identifying structures, analysing images, choosing surgical approach routes and deciding on possible consequences. In the United States, about one third of resident physicians are insufficiently prepared in anatomy,³² which means that some medical errors must result³³ due in part to a lack of anatomical knowledge.³⁴

Technology should be incorporated into curricula, but not totally replace cadaver-based teaching, which should take place early in the programme and be clinically orientated as it is a key element at the start of medical education and training. The recommendations mentioned below are meant to keep cadaveric material available for our students. This provides an early, active learning encounter with mortality where facts are verified from the primary source, discoveries enjoyed and checked against the interpretation of others leading to a three-dimensional understanding of the body, its variation and pathology. In the process, students' manual dexterity and team-work and communication skills will develop and improve. All this will give them confidence and enrich their clinical competence.

As a part of a regional centre for the new Intercollegiate Membership of the Royal Colleges of Surgeons UK examinations (Edinburgh), the College of Medicine & Health Sciences at Sultan Qaboos University, believes that a thorough knowledge of anatomy is essential and mandatory as a preliminary to higher surgical training. The teaching of anatomy in surgical specialities must be improved. Does the dissecting room still have a place in educating our under- and postgraduate students? Our answer is a qualified yes - a sound knowledge of anatomy is essential to define accurately and treat successfully the problem presented by patients. Dissection remains the most powerful way to learn anatomy as a dynamic basis for solving problems.³⁵

CONCLUSIONS AND RECOMMENDATIONS

1. We should aim towards a teaching of anatomy that is clinically oriented and as applicable as possible with closer links between basic scientists and clinicians to enhance teaching and research. Anatomy is a living subject, not a collection of facts learnt early and then forgotten. Retaining anatomical facts requires constant practical application so these must be taught by scientists and clinicians with a clinical perspective. Radiologists, for example, can play a key role in teaching anatomy.
2. In our department at SQU, to palliate the reduction in hours devoted to anatomy, we use prosecutions, peer teaching as learning method and the inclusion of other instructional systems, such as multimedia programmes and computer-assisted teaching which offer a clear, renewable, rapid and efficient way of offering 3-D images. We are also introducing newer technologies, such as the readily expandable and understandable streaming media.
3. Surgeons must address the problem seriously. Detailed knowledge of anatomy can only be obtained by diligent study, preferably as a demonstrator involving six months of learning on prosecutions and teaching undergraduates, together with master class type anatomical tutorials. A three to six months rotating programme for senior house officers in anatomy would enhance their learning, teaching and communication skills. We would even encourage a GCC interchange programme of demonstrators between anatomy departments.
4. The new Membership of the Royal Colleges of Surgeons (UK) contains a rigorous examination in anatomy using dissections, imaging and surface anatomy. This should be mandatory preliminary to entry into higher surgical training. Anatomy should not be left to the exit Fellowship examinations. This will give us better trained young surgeons. Courses in surgical anatomy should be established to attract and train our future surgeons.
5. Adaptation to the new curricular demands and objectives. Our own experience concurs with that of others,³⁶ that anatomy instructors should preferably be trained physicians so that a clinical orientation can be given to the subject.³⁷ Interdepartmental collaboration should also be fostered with the aims of integrating teaching, developing life-long training courses at post-graduate level, and intervening in the training of clinical specialists.³⁸
6. There should be a debate at every level in GCC medical schools. This debate should highlight ar-

eas of concern, explore in depth and define a common minimum core anatomy curriculum as there is currently no agreement on this at undergraduate level. One way would be to reduce the amount at the start of the course, emphasise surface and radiological anatomy and teach sufficient general anatomy for systems-based courses. Teach more anatomy later and throughout the course. But it is rare to have sufficient time later. The perception of the depth of knowledge required by both student and examiner varies widely.

7. Teaching must be enhanced with a critical look at both teachers and methods. The dominance of research must be reassessed to establish an equitable cohabitation with teaching. The place of basic science, especially anatomy in basic surgical teaching, must be examined
8. Planning strategies to compensate for the acute shortage of cadaveric material in the region because of restrictions imposed by various sources. We feel that we should maintain cadaver-based teaching of anatomy, together with computer-assisted teaching as an adjunct.
9. Medical schools that are fortunate enough to have a good bank of cadaveric teaching material are encouraged to develop plastination facilities to make longer and durable use of such resources. Such facilities are already available in some GCC schools like SQU. We are willing to train interested colleagues from other GCC departments.
10. With increasing pressures to admit more students into medical programmes, the student/staff ratio should be improved so that the quality of small group teaching is maintained.
11. Establish a regional anatomical society or body that holds regular scientific meetings, and discusses and publishes anatomical research through the establishment of a regional anatomy journal. This is in line with previous recommendations made by anatomy heads of departments in GCC countries at the First GCC Anatomy Heads of Department Meeting held at King Faisal University, Dammam, Kingdom of Saudi Arabia on 25th April 2000.
12. Encourage regional and international links with other anatomical societies, departments or institutes for exchange visits and feedback to keep up with contemporary educational trends in the dis-

cipline and to encourage collaborative research. Such societies have created a renewed and more dynamic outlook for anatomy. Multilateral meetings between anatomists from all over the world are being fostered and the publication of a new edition of anatomical terminology has been promoted.

"Doctors without anatomy are like moles. They work in the dark and the works of their hands are mounds."
Tiedemann, Heidelberg, 1781-1861.

ACKNOWLEDGEMENT

To all those who, through the spirit of giving, medicine is ever indebted.

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