



Surface anatomy as a relevant tool in contemporary medical education and clinical practice

Dim E. M¹, Edagha I. A², Mbadugha C. C², Peter A. I², Oforjigha-Dim C. W³, Dim U. M. E⁴

¹Department of Orthopaedics and Traumatology, Faculty of Clinical Sciences, University of Uyo, Nigeria

²Department of Human Anatomy, Faculty of Basic Medical Sciences, University of Uyo, Nigeria

³Department of Medical Laboratory Services (Haematology and Blood Transfusion Services), Federal Medical Centre, Ebute-Metta, Lagos, Nigeria

⁴Nursing Services Division, National Orthopaedic Hospital, Igbobi, Lagos, Nigeria

Abstract

The study of human surface anatomy is largely descriptive with interest on the form, proportions of the human body, and the surface landmarks which correspond to deeper structures hidden from view, both in static pose and in motion. From the point of view of first principles in establishing diagnoses and planning appropriate treatment, it is difficult to divest anatomy from clinical medicine. The advent of contemporary, modern and state of the arts diagnostic aids appears to be eroding the relationship between surface anatomy and the teaching and practice of clinical medicine. The aim of this work is to re-emphasize the role of surface anatomy in the teaching and practice of clinical medicine. This is especially relevant at a time like this, when state of the arts imaging techniques seem to be making clinical skills acquisition and demonstration unpopular. A systematic review of the literature on the subject of surface anatomy as it relates to clinical medicine was done. Perspectives on surface anatomy in relation to the teaching and practice of clinical medicine were extracted and presented.

Keywords: Surface, anatomy, contemporary, medical education

Introduction

Surface anatomy is the study of the external features of the body of an animal without anatomical dissection. As a branch of gross anatomy, it is a descriptive science with particular attention to the form and proportions of the human body, and to the surface landmarks which correspond to deeper structures hidden from view, both in static pose and in motion.^{1,2,3} The study and practice of clinical medicine cannot be divested from the study and application of surface anatomy. In clinical medicine, the steps of physical examination by way of inspection, palpation (feeling with the hands), percussion (tapping with the fingers), and

auscultation (listening with the aid of a stethoscope) are premised on the surface landmarks which correspond to deeper structures hidden from view, both in static pose and in motion.^{1,3} A proper physical examination must necessarily be guided by an accurate sense of surface anatomy as a basis for diagnostic precision. It follows, therefore, that clinicians examine living anatomy, and that surface anatomy may be the only anatomy encountered in many professional practices.⁴ It is for these reasons and more that it is desirable for all doctors and other clinical professionals to know the range of normal anatomy, to be able to identify bony and prominent structures, and to know the position of deeply related structures.^{5,6,7} Anecdotal observation across clinicians has shown that advances in available ancillary investigative tools in contemporary times have been associated with the tendency for some clinicians to either play down on or completely ignore the traditional role of physical assessment

Corresponding Author: Dr. E. M. Dim

Department of Orthopaedics and Traumatology,
Faculty of Clinical Sciences, University of Uyo, Nigeria.
E-mail: maduakonamdim@yahoo.com, Phone: +2347037534952

and examination of patients which is premised on the knowledge of surface anatomy of body part or system to be examined. The immediate result of this development is that such clinicians may be incapable of making accurate clinical diagnoses, while depending almost completely on ancillary investigations for the elucidation of patient diagnosis. If this trend is allowed to continue unchecked, a time may come when it will no more be fashionable to teach or expect a clinician to diagnose diseases on the strength of clinical history and surface anatomical examination findings. This implies that physical signs will lose their flavour. Demonstration of physical signs is anchored on the understanding of the relevant surface anatomy, and constitutes a major theme of emphasis in both the undergraduate and postgraduate medical education. The aim of this paper is to emphasize the role of surface anatomy as a relevant tool in contemporary clinical practice and education. This role is anchored on the ability of anatomy and clinical instructors to stimulate the interests of their students and trainees on the subject of surface anatomy.

The role of surface anatomy in clinical medicine

Anatomy has been considered a key element of medical education for centuries. In practice however, with respect to clinical medicine education, the most encountered aspect of anatomy involves living anatomy i.e. anatomy by observation of a living human body.⁸ This is the crux of surface anatomy, whose application covers both the teaching and practice of clinical medicine.

Surface anatomy in the teaching of clinical medicine

The role of surface anatomy in medical education has a long history. The concept of using the living human body to teach anatomy dates back to the 18th century, when Dr. William Hunter used living models for demonstration of movements during his lectures at the Royal academy.^{9,10} In the 19th century, Professor Mathis-Marie Duval also used living anatomy as a teaching tool for medical students.⁴ Burns and Colenso in 1900 authored a manual titled "Living Anatomy", which was the collection of 12 male and eight female illustrations, showing muscles deployed for different bodily actions and activities, and this manual was also used for

teaching. The concept was to showcase surface or living anatomy as an adjunct to cadaveric dissections in the learning of anatomy.¹⁰

The essence of the teaching of physical examination in medical education is to teach students the concept of transferring anatomy that they learnt in the dissection room to the living body.^{10,11} Physical examination has been recognized as a clinical application of surface anatomy, and it is believed that incorporation of clinical details in teaching gross anatomy, including living or surface anatomy and radiological anatomy, promotes students' understanding of gross anatomy.¹⁰ Surface anatomy gives intricate insight on static anatomy of cadavers and also gives students a chance to visualize body parts in living human beings, while also providing an opportunity to identify the variations between the individuals. Surface anatomy provides an opportunity to practice physical examination at a very early stage in medical education, which prepares students for life-long clinical practice.

It has been postulated that with advances in the methodology for the study of surface or living anatomy, the trend for cadaveric dissection as a teaching tool will decline in coming years, and more time will be dedicated to new technology-based practices in the study of anatomy.^{12,13} The current teaching methodologies used for surface anatomy include body painting, peer examination, living anatomy model, and full body digital X-Ray in combination with palpation of landmarks on peers and cadavers, and supplemented with self-directed learning. Body painting was first used in 2012, and it provides an efficient and well accepted learning tool for living and surface anatomy. It provides a platform for promotion of communication skills, and fosters a positive learning atmosphere.¹⁰ Peer physical examination is an important and widely accepted teaching tools in conducting living and surface anatomy sessions.¹² This involves making students to examine life models or fellow students as part of didactic demonstration of surface anatomy sessions. By so doing, students are helped to overcome their feelings of fear and inadequacies, improve their professional attitudes towards patients and gain some level of insight into the experience of the patient.¹⁰ Also, it helps students develop a mental picture of deep organs, facilitate the practice of physical examination during clinical

skills sessions, and expedite the performance of physical examination on patients in clinical settings.¹⁰

Surface anatomy in practicing medicine

Surface anatomy forms the basis for physical examination, which is a core requirement for sound clinical practice.^{10,14,15} A deep knowledge of surface anatomy is recommended for any practicing clinician. A solid grounding in surface anatomy enhances the practice of physical examination, equips the clinician and reduces medical diagnostic errors, which are reported as being responsible for nearly 100,000 deaths per year in the United States.¹⁶ Clinical misdiagnosis may not be the sole cause of medical errors, but they are the most outstanding among other errors in the unfortunate event of a mortality. Another problem of diagnostic errors is that they may, if undetected, pave the way for other errors in the course of management of the patient. In recent times, clinical medicine has advanced alongside supporting technology, increasingly making it the first diagnostic tool the clinician reaches for in certain circumstances.¹⁶ Notwithstanding, physical examinations, by depending heavily on surface anatomy, constitute 'low-hanging fruit' in this era of increasing deployment of supporting technology in diagnosis. They continue to provide insight into what is immediately ascertainable about the actual patient before the clinician.¹⁶ The neglect of physical examination, even in the face of available diagnostic technology, is responsible for avoidable medical errors. Some of these errors also result from faulty, inadequate, careless, or lackadaisical approaches to physical examination, in which clinicians miss obvious clinical signs that could have been detected immediately if the patient had been physically and carefully examined.¹⁶ Therefore, adequate physical examination reduces medical errors, and such adverse events as may arise from failure to perform this relevant examination. Medical errors arising from inadequate physical examination have been poorly quantified and documented.¹⁷ According to Verghese et al., failure to perform the physical examination was responsible for 63 percent of the cases of medical errors in a study in the United States.¹⁷ Misinterpreting or overlooking physical signs were

adduced as other reasons for medical errors in the study.

Conclusion

The study and practice of clinical medicine cannot be divested from the study and application of surface anatomy. In clinical medicine, the steps of physical examination i.e. inspection, palpation, percussion and auscultation are premised on the idea that surface landmarks correspond to deeper structures hidden from view, both in static pose and in motion. Any proper physical examination must necessarily be guided by an accurate sense of surface anatomy as a basis for diagnostic precision. In essence, clinicians examine living anatomy, and surface anatomy is quite often the most encountered anatomy in many professional practices. Thus, surface anatomy is necessarily an indispensable tool in clinical medicine; either in teaching clinical medicine, or in practicing professionally.

References

1. Seeley RR, Stephens TD, Tate P. Anatomy & Physiology (6th Ed.). McGraw & Hill; 2002. ISBN 978-0-07-235113-2.
2. Standring S, Borley NR, Collins P, Crossman AR, Gatzoulis MA, Healy JC, Johnson D, Mahadevan V, Newell RLM, Wigley C. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 40th Ed. 2008; Anatomical Nomenclature, p19. ISBN: 978-0-8089-2371-8.
3. Villee CA. Morphology. Encyclopaedia Britannica, 2018. <https://www.britannica.com/science/morphology-biology>
4. McLachlan JC, Patten D. Anatomy teaching: Ghosts of the past, present and future. Med Educ 2006; 40:243–253.
5. Biggs J. 1996. Enhancing teaching through constructive alignment. Higher Educ 1996; 32:347–64.
6. Louw G., Eizenberg N., Carmichael SW. 2009. The place of anatomy in medical education: AMEE Guide no 41. Med Teach 2009; 31:373–386.
7. Judson JP. The anatomy of anatomy. Int eJ Sci Med Educ 2012; 6:S48–S52.
8. Arráez-Aybar LA, Sánchez-Montesinos I, Mirapeix RM, Mompeo-Corredera B, Sañudo-

- Tejero JR. Relevance of human anatomy in daily clinical practice. *Ann Anat.* 2010; 192 (6): 341-8. doi: 10.1016/j.aanat.2010.05.002. Epub 2010 Jun 11. PMID: 20591641
9. Strathern P. A brief history of medicine from Hippocrates to gene therapy. 1st Ed. New York 2005; Carroll and Graf Publisher. 414p
 10. Asad MR, Nasir N. Role of living and surface anatomy in current trends of medical education. *International Journal of Advance Research and Innovative Ideas in Education* 2015; 1(2): 203-210
 11. Barrows HS, Patek PR, Abrahamson S. Introduction of the living human body in freshman gross anatomy. *Br J Med Educ* 1968; 2:33-35.
 12. Ganguly P K, Chan L K. Living anatomy in the 21st century: How far can we go? *South East Asian J Med Educ* 2008; 2:52-57.
 13. Gabard DL, Lowe DL, Chang JW. Current and future instructional methods and influencing factors in anatomy instruction in physical therapy and medical schools in the United States. *J Allied Health* 2012; 41:53-62
 14. Bowsher D. What should be taught in anatomy? *Med Educ* 1976; 10:132-134.
 15. Metcalf NF, Prentice ED, Metcalf WK, Stinson WW. Peer group models in examination instruction as an integral part of medical gross-anatomy. *J Med Educ* 1982; 57:641-644.
 16. Kohn KT, Corrigan JM, Donaldson MS. *To err is human: Building a safer health system.* National Academy Press 1999; Washington, DC.
 17. Verghese A, Charlton B, Kassirer JP, Ramsey M, Ioannidis JPA. (2015). Inadequacies of physical examination as a cause of medical errors and adverse events: A collection of vignettes. *The American Journal of Medicine* 2015; 128 (12): 1322-1324. e3