



A Need to Protect the Health and Rights of Anatomists Working in Dissection Laboratories

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Abstract: Anatomy in the context of medical or health science often requires dissection. Anatomical dissection is the purposeful and procedural exploration of the human tissues and organs by physically cutting through defined body planes, regions, and organs to access, define and explore the structures in a manner that facilitates learning. Anatomical dissection is a basic requirement for anatomical and medical education. It is a requirement in certain other fields of health sciences as well. Unfortunately, in many instances, the prosector and dissector in the anatomy laboratories are not considered for the hazards to which they are exposed whether in their health plans or remuneration package. Dissectors, unlike conventional hospital laboratory workers are often considered routine workers or teaching assistants. This is the case, for example, in many African medical institutions. Administrators possibly presume that hazards are only associated with service laboratories in the hospital or teaching hospital departments. It would therefore serve the purpose of advocacy, education, and orientation to highlight the hazards that these individuals who serve as dissectors, prosectors and laboratory staff members are exposed to. This commentary highlights the nature and sources of risks that anatomists who dissect, prosect and work in anatomical laboratories are exposed to. It also highlights how the rights and health of anatomists who dissect can be protected with specific recommendations. Hence, the recommendations speak to policies and practices that are required to serve this purpose. After highlighting the major risks that anatomists who dissect might face, and the major causes of the risks, we wish to propose ways by which these could be addressed based on these key considerations: protect, prevent, and compensate. This is what we have also termed the PPC principle for protecting the health and professional rights of anatomists who dissect and work in anatomical laboratories.

Keywords: anatomy, dissection, cadaver, health, risks, right, education, laboratory

Introduction

The human body is the most important workshop for a student of the discipline of Anatomy. Anatomical dissections do not just enhance the cognitive domain of learning or knowledge but also help the student of the subject to acquire exploratory skills that could be further enhanced and applied to the fields of anatomical sciences and surgery among others.¹ This buttresses the fact that anatomical dissection helps learning in the psychomotor domain. In addition to this, it has influences on the attitude of the learner as it provides opportunity for contact, and clear appreciation of the morphological construct of the human body. This influences the learner in the affective domain in ways that no representation could possibly do. Life is appreciated in contrast with death during anatomical dissections and it might have a very strong affective impact on the life of an anatomist or doctor in training. While digital dissection, the use of models, animated graphics as well as 3D replication of human body parts and organs have been proposed and with strong advocacy in recent times, the traditional dissection remains the gold standard for many institutions. Anatomical dissection has been done for ages for the purpose of teaching human anatomy. Certain other institutions, in addition to dissection, would rather use EdTech and other materials as complementary teaching materials or aids. It is important to

note that the traditional dissection is carried out in the gross anatomy laboratories of anatomical, medical or health science schools for hands-on training, education, and development of surgical skills.

The above explains why cadaveric anatomy dissections and prosection have been and will remain an integral aspect of training anatomists and doctors as well as other health professionals.¹ To this end, there is a need to train future anatomists and doctors and to acquire knowledge of the basic principles of human body dissection and exploration, and a proper comprehension of the gross human morphology. In the process of anatomy education, the dissectors and the prosectors are professionals with knowledge of the gross human body or morphology and the skills to technically dissect the human body and represent the same in an educative way that promote learning. Certain individuals and organisations have dissected and presented human bodies for various reasons, including general observations and possibly for amusement. The Anatomy dissector or prosector is therefore a skilled individual and an educator, who in the first instance should have been certified to understand the human body organization.

Routine Engagements of Gross Anatomy Laboratory Staff

Technical and teaching staff who work in the gross anatomy laboratory of medical schools routinely engage in the following activities.

- (i) Receiving unclaimed or donated bodies/cadavers and embalming them for long-term preservation for the purpose of anatomical examination.
- (ii) Regularly carrying cadavers to and from the body storeroom and dissection room for practical classes of medical and allied health students.
- (iii) Prosecting the cadavers for anatomical examination and guiding the students through their practical classes on prosected cadavers; in many instances, leading the students in dissecting cadavers during practical classes.
- (iv) Storing and curating organ structures harvested from prosected/dissected cadavers for development and maintenance of anatomy museum.
- (v) Handling laboratory wastes and ensuring the proper disposal of the wastes in a manner to contain possible public health hazards.

While handling these routine tasks, gross anatomy laboratory staff are repeatedly exposed to health risks and hazards.

Health Hazards That Dissector and Prosectors are Exposed to Chemical Hazards

An Anatomy dissection laboratory staff is exposed to chemical hazards by direct contact and as air contaminant. Formalin is a chemical substance that is a primary constituent of the embalming fluid used in preserving the cadaver in many instances. Raja and Sultana² had reported that acute effects of the chemical on dissectors could include nausea, headache, and ocular irritation that causes tear overflow and a burning sensation in the throat while the long-term exposure effects might include dermatitis, congenital anomalies from foetal exposure and cancer. Mathangasinghe et al,³ in an audit report had stated that students, during dissection had specifically identified health hazards and risks of exposure that arise from contact of fluids with skin, eye, and exposed body parts as well as cuts. These experiences are, however, not necessarily limited to students; dissectors, hence anatomists who dissect also suffer similar hazards. Reports had indicated that in many anatomical dissection laboratories across the world, workers and trainees might be exposed to formaldehyde above its permissible exposure limit or PEL which is 0.75 ppm of air, typically measured as an 8-hour time-weighted average, with a second permissible exposure limit or PEL as a short-term exposure limit of 2 ppm with maximum exposure allowed for 15 minutes.^{4,5} There have been instances such as in Japan⁶ and India⁷ where exposure had been reported to be above the accepted values, and with possible potential hazards ranging from the relatively mild ones such as irritation of the eyes and the skin to the relatively serious and severe effects such as cancer [Protano et al, 2021].⁸ Other chemical substances in the embalment fluid could also have deleterious effects when exposure is above certain thresholds.

Biological Hazards

Exposure to biological hazards in the gross anatomy laboratory is usually from body fluid and blood, sharp instruments and objects and air contaminants. Cadavers, although usually preserved could still carry infections. Cadavers have been reported to pose health risks because of certain infections that are found on them.^{9,10} While the preservatives in the embalming fluid relatively have the potency to fix body tissues and certain biological elements including pathogens, this effect might not be absolute; hence, cadavers could still carry infections. It has been reported that some of such infections might include *Mycobacterium tuberculosis*, hepatitis B and C, the AIDS virus HIV, as well as prions.¹¹ Amadi¹² had advocated for proper chemical treatment and embalment of HIV/AIDS infected bodies, and the need to delay dissection until long enough for the virus to die, which was estimated to be not less than 30 days after death. Owolabi et al¹³ also advocated for the need to ensure proper management of human remains, particularly by professionals and in line with statutory regulations.

Physical/Musculoskeletal Hazards

These are usually as a result of injuries from manual tasks in the laboratory. Regular handling, lifting and transportation of cadavers cause muscle strain and sprain, wear and tear to the joints, ligaments, tendons, muscles and other musculoskeletal structures, over-exertion and a host of ergonomic issues to the staff of gross anatomy laboratory. Traumatic injuries among these staff have been documented to be caused by the dissection instruments, especially the sharp tools, leading to open wounds and bleeding. Cornwall et al¹⁴ had reported that student dissectors do have cut injuries particular on their fingers and the thumbs.

Psychological Disturbances

A number of authors have reported the psychological effects of cadaver dissections, especially during initial experiences. Zubair, Waheed, and Shuja¹⁵ had reported that the first-time exposure could cause acute stress disorder (ASD) in students. This was also similar to the report of Javadnia et al.¹⁶ In several instances, such psychological impacts were reported to have abated over time or with repeated exposure. There is, however, usually little or insignificant preparation for the psychological impacts of cadaveric dissections on anatomists whose primary roles include being dissectors, prosectors and demonstrators, using human cadavers. Since they are humans, it would be expected that their nature of work, being peculiar, would also have a peculiar impact on their psychological and/or psychosocial health.

Risk Sources and Causes of Hazards in Gross Anatomy Laboratory

1. Poor protective clothing
2. Poor laboratory facilities
3. Poor ventilation and facility set up
4. Poor cadaver acquisition, preservation, and storage processes
5. Negligent of standard practices
6. Understaff in the laboratory
7. Poor working environment including poor laboratory setup and lack of proper equipment.
8. Poor culture of laboratory management
9. Lack of adequate training, knowledge, and skills
10. Lack of effective lab practice guide and manuals

Recommendations: Protect, Prevent, and Compensate – The PPC Principle

Anatomy dissections include cutting through preserved human body or body parts and remains using dissection and surgical tools. This also implies that the dissector or prosector is exposed to the cadaver and its preservatives. Furthermore, the dissector or prosector comes in direct contact with the human body or cadaver including its various components such as body fluids and secretions within the body. Occasionally, body fluids and embalming solutions that have spilled over the bodies of dissectors, requiring washing and cleaning. The human body that is used in anatomy dissection is usually preserved using chemical

methods – although bodies can first be kept in refrigerating chambers, they would eventually be embalmed as a standard practice before being used for dissection. The embalming fluid is a mixture of chemicals of which formaldehyde is a popular and frequently used one. These chemicals have their effects often on the respiratory system which might include acute irritation and probably cancer in cases of prolonged exposure. Furthermore, the eyes can be irritated by these chemicals as well as the skin. While the fumes typically get in touch with the eyes, the chemicals irritate the skin, even when gloves are worn, sometimes. The typical smell of the preserved body, which can remain on lab clothing after sessions as well and the effects emotional feelings that are associated with cutting up human bodies are also significant. Considering all these, the dissector and prosector is exposed to specific significant health hazards both physically and psychologically. There is a crucial need to protect the anatomist in the context of such a working environment and conditions. For example, proper ventilation, as well as monitoring and maintaining formalin exposure below the permissible exposure limit might help to significantly alleviate its associated health risks.^{4,17}

Having highlighted some of the major risks that anatomists who dissect in the gross anatomy laboratory might face in the course of their professional work or duties, and the major causes of the risks; we wish to propose ways by which these could be addressed based on these key considerations: Protect, prevent and compensate. This is what we have also termed the PPC principle for protecting the health and professional rights of anatomists who dissect. The following recommendations are considered potentially helpful:

Protecting Anatomists Who Dissect

1. Protect the anatomists who dissect from infections on bodies by checking for infections on bodies before use, keeping a quality record of cause of death, and ensuring that only adequately embalmed, sterilized and safe bodies are used.
2. Protect the anatomists who dissect from the hazard of chemical agents by giving them adequate personal protective equipment.
3. Protect the mental health of anatomists who dissect by providing an optimally enabling working environment and ensuring proper acquisition and use of cadavers.
4. Immunization – provide adequate immunization to anatomist who dissect against major infections especially hepatitis.
5. Insurance – provide work-related health insurance cover to anatomists who dissect.

Preventing Hazards to Anatomists Who Dissect

1. Preserving bodies in the best possible ways to limit the presence of infectious agents on the bodies.
2. Using the best approaches to preservations for the bodies and limiting the use and exposures to hazardous agents; avoiding formalin use or exposure where possible.
3. Training anatomists who dissect on methods, skills, and best practices with respect to cadaver dissections, prosecutions and management of the remains post-dissection.
4. Obtaining cadavers through standardized ways that ensure proper management of bodies and limiting of hazards.
5. Ensuring best practices in managing dissection equipment, such as sterilizing them to prevent them from carrying infections and keeping them in best working conditions to limit injuries.

Compensating Anatomists Who Dissect Adequately

1. Paying commensurate hazard allowances to anatomists who dissect for their exposures to risks as identified.
2. Compensating for the risk exposure duration by being given adequate leave or out-of-cadaver-lab time off.
3. Ensuring a reliable and quality career prospect for anatomists who dissect.
4. Providing regular health examination services to anatomists who dissect.
5. Attributing proper workload values/units for the work of anatomist who dissect.

Conclusion

Dissection is a traditional pedagogical practice that is as old as the practice of anatomy, and the field of anatomical sciences. In fact, dissection has defined anatomy as a science as it serves the essence of the root word. Despite being

considered by some as ancient and traditional practice, it has remained central and integral to the practice and teaching of anatomy especially from the gross perspective. This would imply that dissection is vital to the practices and teaching of anatomy, especially human anatomy in the context of anatomical and medical sciences. To this end, anatomists who dissect are indispensable to the practice, and the world of anatomy, and this would warrant that their health and rights to optimally enabling and ideal working environment as well as rights to have their health risks addressed are very important. We therefore advocate strongly for this category of anatomists, particularly in Africa and the developing world. This advocacy, however, remains quite relevant across the world. Policies and practices to protect the rights and health of anatomists who dissect should be put in place. We advocate for the need to protect anatomists that work in dissection facilities by limiting risks and compensating for work-related hazards with commensurate remunerations.

Disclosure

The authors report no conflicts of interest in this work.

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