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Anatomical dissection in human cadavers: re-signification of ancient practices of teaching human anatomy as a learning strategy in medical school

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Abstract. Anatomical dissection of human cadavers is a fundamental practice in the teaching of anatomy, providing a three-dimensional visualization of the body's structures and the development of clinical skills. Despite technological advances and the use of virtual anatomical models, dissection remains an effective method by promoting hands-on experience and consolidating knowledge. Thus, the present study aimed to report the creation and implementation of an anatomical dissection course on human cadavers, held between April and May 2024, at a public university in the state of Piauí, highlighting its importance for the education of healthcare students. For the course's effectiveness, days before the

practical lessons, the cadavers used during the course were removed from the formaldehyde tanks, washed to remove excess formalin, and properly prepared to allow the incisions by the scalpel to occur naturally and without difficulty, through hair removal on the cadavers. Additionally, scalpel handles equipped with No. 24 blades, straight Metzenbaum scissors, straight iris scissors, needle holders, nylon suture threads with No. 4 needles, rat-tooth forceps, and anatomical dissection forceps were laid out on the benches for use in both cadaver dissection practices and during suture training. Furthermore, theoretical lessons on biosafety, simple suture techniques - simple stitch and X-stitch - as well as lessons on anatomical planes and practical dissection activities of the integumentary system, adipose tissue, and viscera were conducted. The adopted methodology allowed for the preservation of a cadaveric collection for study, strengthening the connection between theory and practice. Moreover, it facilitated the discussion of the bioethical and legal aspects of using cadavers in education, considering different cultural and legal perspectives. Therefore, it is concluded that anatomical dissection should remain an essential teaching strategy, combined with new technologies to enhance the learning of human anatomy.
Keywords: Cadaveric dissection, teaching methodologies, medical education, human anatomy.

Introduction

Anatomy is a fundamental field that has existed since ancient times when civilizations like the Egyptian and Mesopotamian began describing the first structures of the human body. During that time, physicians and surgeons blended science and magic to combat the diseases that affected the population. The first recorded dissection of a human cadaver took place in 510 BC, conducted by Alcmaeon of Croton in Greece (Starling, 2017).

These early dissections were often carried out as public spectacles, frequently involving individuals sentenced for crimes, and typically occurred during specific times of the year. In the 16th century, Andreas Vesalius challenged the ancient theories of Galen by publishing the book *De humani corporis fabrica*, which revolutionized the understanding of human anatomy. In the 19th century, with the development of formaldehyde for the preservation of anatomical specimens, it became possible to preserve these structures for further study. This led to new paradigms regarding the use of human cadavers in laboratories, necessitating the establishment of bioethical and moral values for the practice (Starling, 2017).

In this sense, the teaching of human anatomy requires a balance between memorization, comprehension, and visualization, given the vast number of anatomical structures that must be studied (Pontinha; Soeiro, 2014).

For dissections to take place, the bodies must be preserved, usually in formaldehyde with varying concentrations. Dissections should occur with students properly outfitted, and after the practical sessions, the environment, instruments, and workstations must be cleaned and disinfected to reduce the risk of contamination (Pontinha; Soeiro, 2014).

Dissection can be performed on cadavers that have never been dissected, or through a technique called prosection, which involves dissecting previously prepared specimens.

Regarding the bodies, schools have opted for so-called "unclaimed" cadavers, but in some countries, the prevailing practice is donation during life, while in others, cadavers come from criminals who have been judicially executed. Thus, a dichotomy arises between the use of cadavers and the societal attitudes that do not align with their use or the respect that they deserve. In this sense, their use should be guided by constant dialogue between physicians, academics, legal experts, and bioethics specialists (Pontinha; Soeiro, 2014).

It can therefore be stated that the manipulation of cadaveric specimens by students influences their future professional conduct with patients.

Thus, it becomes evident that discrepancies in ideas regarding the use of cadavers for study purposes or not are associated with the ongoing discussion of death as a part of human daily life. Consequently, the practice of dissections should not be seen as an isolated teaching method for learning human anatomy, but should be combined with new approaches to optimize student learning, in a constant integration of historical dissection practices, the use of atlases for better visualization of anatomical structures, and new technologies (Costa et al., 2012).

Methods

Type of Research

This research is a qualitative, descriptive study of the type *experience report* (Andrade Júnior; Barbosa, 2017), conducted based on the experiences gained during the first anatomical dissection course on human cadavers, organized by the Medical-Surgical Anatomy League at the State University of Piauí, between April and June of 2024.

Characterization of the Organization

The present study was conducted in the anatomy laboratory of the State University of Piauí (UESPI), Poeta Torquato Neto campus, linked to the Center for Health Sciences (CCS/Uespi). The laboratory is equipped with suitable facilities for anatomical dissection practices, including tanks for cadaver storage, dissection benches, surgical instruments, and biosafety equipment.

The dissection course was organized by the Academic League of Medical-Surgical Anatomy, with support from the league's pedagogical coordination. This initiative emerged from the need to enhance human anatomy education, providing students with hands-on experience with real anatomical

structures, complementing the theoretical and digital approaches available.

The course involved the participation of medical students from UESPI and other higher education institutions, as well as students from other health-related fields, and was supported by professors and laboratory technicians specialized in anatomy. The methodology included both theoretical and practical lessons covering topics such as biosafety, dissection techniques, suturing, and anatomical planes.

The entire course structure was designed to ensure the safety of participants, following bioethical and legal standards related to the use of cadavers for academic purposes. The cadavers used in the course were properly preserved in formaldehyde solution, in accordance with current regulations, and dissections were conducted under the supervision of qualified professionals.

Experience report

The dissection practices were specifically designed to facilitate the teaching and learning of human anatomy through the visualization and manipulation of real structures, functioning as a teaching methodology.

Thus, the course was developed addressing topics related to the bioethical values involved in the matter, biosafety within the laboratory context, dissection techniques for organs, tissues, and their manipulation, as well as understanding anatomical planes and axes of delimitation.

As a result, at the end of the course, the new anatomical structures began to be used, whenever necessary, by students enrolled in the courses of Medical-Surgical Anatomy I and II, the Academic League of Medical-Surgical Anatomy, and students from other programs at the Center for Health Sciences.

The course was structured based on the Law Project No. 4.272-A, of 2016, which "regulates the use of unclaimed cadavers for study or scientific research purposes," aiming at improving the training of surgical techniques and ensuring that real-life situations with living patients are conducted in the best and safest way possible (Brazil, 2024).

Therefore, the creation of the anatomical dissection course was justified by the real need to continue the debate on the importance of human dissections as a three-dimensional visual experience, with the naked eye, through the manipulation and visualization of human body structures, the acquisition of practical skills with surgical instruments, the handling of organs and tissues, and their relationships with other anatomical structures (Marinho; Malafaia, 2023). It also provides a real understanding of anatomical planes, axes, and boundaries, which are important in the interpretation of certain imaging exams and the relationship between doctors and radiologists through the explanation of these exams (Moreira et al., 2021).

Medical education is a continuous process that integrates theoretical knowledge and technical skills. In this context, the dissection of formalin-preserved cadaveric specimens consolidates as a fundamental practice in the teaching of anatomy, significantly contributing to the development of the competencies necessary for medical practice (Moreira et al., 2021).

Moreover, the real connection between theoretical knowledge learned in the classroom, practical knowledge from laboratories, and group discussions through the observation of structures leads to an easier interpretation of what is seen during dissection and the exploration of anatomical structures during the dissection itself.

Therefore, the dissection course not only allowed students to develop individual skills but also collective ones, such as communication and interpersonal relations.

In this sense, when conducted during the undergraduate years, the cadaver becomes the student's first patient, and thus, the practice of dissections allows for the development of bioethical and moral values that will shape the future medical careers of these students (Moreira et al., 2021).

In this perspective, it seems pertinent to use anatomical dissection as a teaching methodology, rethinking the teaching of human anatomy by combining ancient practices with new learning strategies.

Finally, the goal of this experience report is to evaluate the practice of anatomical dissection as an effective teaching methodology when applied during medical undergraduate education.

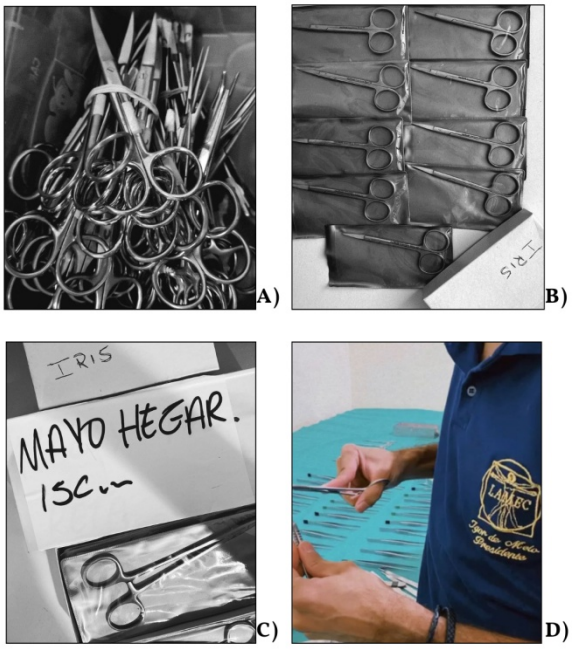

Figure 1. Instruments used throughout the 1st anatomical dissection course. A) Straight Metzenbaum scissors; B) Straight iris scissors; C) Mayo Hegar needle holder; D) Arrangement and setup of the instruments, one day before the practical lessons, on the respective benches.

Development of a Low-Cost Human Cadaver Dissection Course at a Public University in the State of Piauí for Health Students

For the mentioned research, the real impact of the anatomical dissection course as a teaching methodology was analyzed throughout the academic semester, following the completion of the course and the introduction of the main anatomical structures visible during dissections, as well as human skin for performing suturing techniques and surgical knots—resources that had previously been unavailable in the laboratory for students.

Figure 2. Students performing practices during the course. A) Beginning the incision on the cadavers to remove the integumentary system; B) Human skin being reflected to access the adipose tissue; C) Student performing suturing on human cadaver skin after the tissue removal during the course; D) Removal of adipose tissue to access the muscles.

Due to the increasingly bureaucratic process and limitations on the compulsory request of bodies by universities, there is a growing shortage of important anatomical structures, such as organs and tissues, in anatomy laboratories for conducting practical lessons, monitoring sessions, and practical exams. This has led instructors to replace missing anatomical pieces with synthetic structures for monitoring and exams, resulting in a learning deficit due to the absence of real, three-dimensional anatomical specimens.

Therefore, the idea of cadaver dissection for maintaining an anatomical specimen collection seems pertinent, as it allows for a better learning experience for students regarding Human Anatomy. This would also include supporting materials with information on bioethics, biosafety regulations, cadaver dissection techniques, main visible anatomical structures, handling methods for organs and tissues in anatomy labs, anatomical planes and axes of delimitation, and legal and judicial aspects.

For the implementation of the 1st Human Cadaver Dissection Course, several steps were necessary to ensure its success, as the limited availability of anatomical structures at the university made a high-cost course unfeasible, both in terms of construction and student enrollment fees.

In this context, there was a need to create an accessible and high-quality course for the students. To achieve this, human cadavers from the anatomy lab at the Center for Health Sciences (C.C.S/Uespi) at UESPI, Poeta Torquato Neto Campus, Teresina, were used. Two cadavers were studied using the prosection technique, which allows for the dissection of previously dissected structures.

The cadavers were kept in a controlled room temperature (23 ± 2 ºC) and stored in tanks containing formaldehyde solutions appropriate for their preservation. At that time, the lab had two previously dissected cadavers: one with only the lower limb dissected and another with the upper limb dissected. The available cadavers were used, and the participants were divided across different benches for their work.

The course syllabus was divided into moments for building the theoretical material used during the practical lessons and time dedicated to performing human cadaveric dissections, as well as theoretical lessons on biosafety, suturing, and anatomical planes and axes of delimitation. A practical suturing session for the students was also included, and all practical moments were recorded for the later writing of the scientific article.

Additionally, students were allowed access to the laboratory only after attending the theoretical class on biosafety within the laboratory context. They were also required to wear personal protective equipment provided by the league—such as N95 masks, procedure gloves, and their personal lab coats—before entering.

Finally, the course was registered with the PREX (Pro-Rectorate of Extension, Student Affairs, and Community Services) at the institution, so that upon completion, all participants received a certificate valid for residency exams and competitive selection processes.


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CERTIFICADO

A Universidade Estadual do Piauí - UESPI, por meio da Pró-Reitoria de Extensão, Assuntos Estudantis e Comunitários - PREX certifica que **IGOR DE MELO OLIVEIRA** participou do(a) CURSO DE DISSECAÇÃO ANATÔMICA, como atividade do Programa de Extensão: LIGA ACADÊMICA DE ANATOMIA MÉDICO-CIRÚRGICA - LAMEC, realizado(a) no período de 20 de abril a 01 de junho de 2024, **Categoria: Ligante Presidente** na cidade de Teresina-PI.

Teresina (PI), 30 de Setembro de 2024.

Figure 3. Certificate issued by the Pro-Rectorate of Extension, Student Affairs, and Community Services - PREX.

Writing the Course Syllabus

The drafting of the course syllabus was a critical and essential point for the continuation of the event, as the document outlined important data that served as the foundation and guidelines for the course. It included key details such as the course theme, workload, type of component, target audience, registration fee, and number of spots, which were defined as follows: human cadaver dissection course, 60 hours, course type, for students and alumni from health-related courses, with 12 spots for the external community and 21 spots for league members, totaling 33 participants.

Additionally, essential information was established, such as the course objectives and justification for its creation. The goal was to enable participants in the handling of cadavers for anatomical and tissue purposes, using techniques like perfusion, basic dissection for dissections and excisions, suturing, and collection maintenance.

Furthermore, the teaching module topics were agreed upon, as well as the evaluation criteria for obtaining the certificate at the end of the course. These criteria included engagement and attendance of over 70% in the offered course. Financial resources were provided by the organizing league and generated from registration fees to fund laboratory technicians, equipment, and materials used throughout the course. The course bibliography was also specified, and the methodology applied was outlined.

Figure 4. Course promotions on the official pages of the Medical-Surgical Anatomy League on Instagram and the State University of Piauí on Google. A) Course promotion; B) Article about the course on the UESPI website, including an interview with the league president and all syllabus information; C) Promotion of the course modules.

Course Promotion

The entire promotion of the course and its visual identity, from the creation of a brand to the printed materials, was developed by the marketing team of the Academic League of Medical-Surgical Anatomy, which designed the human cadaver dissection course. The first step in promoting the course was the creation of a unique visual identity months in advance, to be used as the event's logo on all promotional materials. The main channels for promotion were the internet and social media platforms, particularly WhatsApp and Instagram, with the league's Instagram profile being the most frequently used.

The course promotion followed a chronological sequence of advertisements, starting with the course announcement, followed by the publication of the official notice and general information, release of the first registration batch, course schedule and modules, and concluding with announcements of the professors responsible for the modules. All promotions were posted as images on the league's Instagram profile and later shared through WhatsApp groups within the medical academic community.

Additionally, banners featuring the event and league logos were used to promote the course. This informational material was displayed at the location where the student training took place.

Writing the Teaching Modules

The writing of the teaching modules was developed to facilitate the retention of the content taught by the instructors during the lessons, as well as to serve as teaching material for further exploration of the subject.

Module I covered the topic "Planes, Axes, and Anatomical Terminology," discussing subjects such as regional anatomy, which involves the organization of the human body into main parts or segments, and anatomical terminology, which defines the planes and anatomical position of the human body, along with terms of relation and comparison related to body movements and measurements.

Module II, in turn, focused on "Biosafety in the Context of Anatomy Laboratories," addressing introductory topics such as ensuring safety, the rules for using human anatomy laboratories, and biosafety standards. These were crucial for guaranteeing good safety practices during all procedures involving chemical or biological materials in the course, allowing the event to be concluded without incidents. Furthermore, this module discussed topics on respecting the cadaver and the use of formaldehyde, including its toxicity, carcinogenicity, reactivity, hazard identification, and first aid.

Module III emphasized dissection, providing information on how to perform dissection on each part of the body. The program content included:

upper limbs, with skin and cutaneous nerves; thoracic cavity; head and neck, with dissection of the scalp, meninges, brain, and cranial nerves; and finally, lower limbs, with a focus on dissection of superficial vessels and nerves, the anterior, medial, and posterior thigh regions. These topics were essential for learning the correct technique and guidance for dissection.

Finally, **Module IV**, with the topic "Suturing," covered both basic and advanced suturing techniques and procedures. It discussed the indications and contraindications for performing sutures, the selection of suturing materials, types of knots, and appropriate techniques for different situations, as well as basic suturing methods.

Additionally, the module addressed procedures that should be done before suturing, such as the selection and understanding of surgical instruments, types and techniques of anesthesia application, asepsis and antisepsis of the area, preparation of the surgical field, infection prevention, and management of potential complications.

Thus, by understanding the theory behind suturing techniques and applying them in practice with material obtained from cadaver dissections, the teaching approach bridged theory and hands-on training, enabling participants to gain greater confidence in the technique and providing a more effective learning experience without harming living patients, ensuring safe teaching.

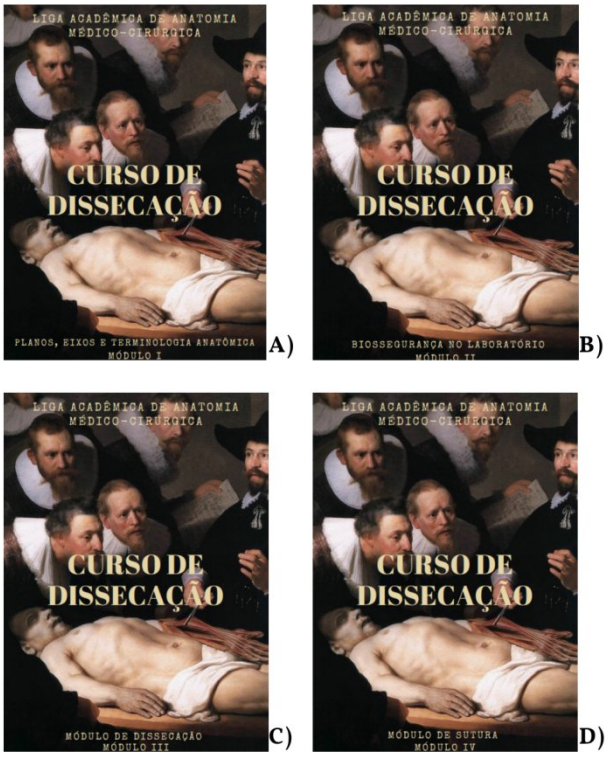

Figure 5. Modules written by LAMEC. A) Module on anatomical planes, axes, and delimitation; B) Module on biosafety in the laboratory; C) Dissection module; D) Suturing module.

Opening class of the course

The opening class was divided into two distinct moments. The first part involved the distribution of the course's teaching materials to each participant, which included 4 printed and colored booklets in A4 format, each corresponding to one of the course modules. In addition to the teaching materials, a gift kit was provided, containing: A welcome letter for the participants, a notepad, and a pen, both personalized with the course's visual identity, and three KN95 face masks.

Figura 6. Distribution of the course modules to participants during the opening class.

Figure 7. Kit given to participants during the opening class, containing general guidelines, gifts, and personal protective equipment used throughout the course.

The second part of the opening class was a lecture on anatomical planes, axes, and delimitation, held on April 20, 2024, from 8:00 AM to 9:30 AM, delivered by Professor Msc. Manoel Monte Carvalho Filho in the anatomy laboratory classroom at the State University of Piauí. In this way, both the class and the teaching module were created with the purpose of providing a general introduction and disseminating knowledge about the basic and advanced anatomy of the human body at the start of the course. The aim was to review concepts such as planes, axes, and anatomical delimitation of the human body, with the goal of facilitating and assisting participants during the dissection practice.

Figura 8. Pedagogical coordinator of LAMEC (Prof. Dr. Samylla Miranda Monte Muniz); Speaker of the opening lecture (Prof. Msc. Manoel Monte Carvalho Filho), and the president of LAMEC (Igor de Melo Oliveira).

Theoretical Class on Biosafety in Laboratory Contexts

This teaching module was designed to be inserted at one of the initial stages of the course, as knowledge about biosafety in a laboratory is a crucial step in preserving not only cadaveric specimens but also in preventing potential accidents with sharp objects and ensuring personal safety against contamination risks. Thus, this class was taught in a classroom during the meeting after the inaugural lecture on anatomical fundamentals, on April 27, 2024, from 8:00 AM to 9:30 AM, by Professor Dr. Liline Maria Soares Martins.

Theoretical Class on Suture Techniques and Surgical Knots

The theoretical class on suture techniques and surgical knots was placed in the final modules of the course because once students had made the incision on the cadaver and performed dissection and removal of some organs, the cadaver could be closed again for better preservation and presentation of the cadaveric material for future practices. Additionally, there was a use of biological material, as skin material was dissected and preserved in formaldehyde, to avoid discarding material and to practice suturing points and surgical knots, essential skills for the healthcare field. Thus, the technical knowledge was delivered in the classroom by Professor Dr. Gustavo Santos de Sousa on May 11, 2024, from 8:00 AM to 9:30 AM.

Practical Class on Suture Techniques and Surgical Knots

The practical class on suture techniques and surgical knots was the last teaching module administered, as after all cadaver dissection and removal of visceral pieces, the biological material was intended to be closed for later use and preservation of the specimen. Therefore, the practical session, held after the theoretical portion of the course, allowed for the consolidation of previous learning and refinement of surgical technical skills. This class was led by Professor Zilton Lima Verde on June 1, 2024, from 8:00 AM to 1:00 PM, in the Anatomy Laboratory, where students were divided into 3 workstations. During the session, each student was provided with a 3-0 nylon suturing thread, a forceps, a needle holder, and straight scissors at the stations for use when necessary.

Practical Dissection on Human Cadavers

The dissection practice was carried out over six classroom sessions, after which students moved to the Anatomy Laboratory to apply the knowledge they had acquired during the day and advance in the practice of cadaver dissection. For the dissection, three cadavers were distributed to their respective workstations, where students were pre-assigned to ensure the more efficient use of the material.

Thus, for the dissection activity, each student was provided with a scalpel with a blade and a forceps to assist in the manual removal of anatomical tissues. Furthermore, all practices were supervised by a specialized technician in human cadaver dissection to assist students and perform cutting procedures on the materials.

Figura 9. Student practicing dissection on a human cadaver.

Final considerations

The realization of the I Anatomical Dissection Course in Human Cadaver, organized by the Medical-Surgical Anatomy League of UESPI, provided a valuable experience, highlighting dissection as a fundamental tool in anatomy education. The practice allowed for an effective correlation between theory and anatomical reality, in addition to fostering the development of technical skills and reflection on bioethical issues.

Moreover, the organization of this course reinforced the role of extension projects in the democratization of knowledge, offering access to learning in an affordable and economical way for students from different social backgrounds.

Thus, it is concluded that cadaveric dissection should be preserved and enhanced in the curricula of health-related courses, integrating with new technologies to strengthen the teaching-learning process.

Acknowledgments

To all the professors who kindly dedicated their time on weekends to train a new generation eager for knowledge. To the pedagogical coordination of the Medical-Surgical Anatomy League, to the State University of Piauí, and to all the course participants who believed in the success of this project.

To everyone who helped us prove, through time, that anything is possible when you believe in your project and when there are people willing to overcome the boundaries of fear and uncertainty alongside you.

To the phrase "in this place, death delights in assisting life," whose exact authorship I do not know but is attributed to the inscription in the anatomy room at the University of Vienna. It was through this phrase that I found inspiration to establish the League and build courses aimed at the community.

And finally, to all the cadavers in the laboratory who, kindly and without choice, donated their bodies for our learning. We have made great strides in ensuring rights and how to proceed with our living patients, but it is in courses like this that I find hope for advancing more rights for our deceased patients.

Those who arrive without a name, without identification, without an identity, but with a story marked by abandonment and loneliness, and who patiently and silently wait for the days when we will reach them, so they can teach us in silence what they have to offer.

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