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Original Research Article

A Multipurpose Cadaveric Prosection for Anatomy Education

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ABSTRACT

The use of dissections had been the core approach to anatomy education for undergraduate medical and allied health sciences for centuries. However, the move towards integration of basic and clinical sciences has resulted in the decline of gross anatomy as a separate subject in many medical schools in the United States. This has led to the creative use of various technological tools in instruction, but the benefits of cadavers in comprehending the complexities of the human structure cannot be overlooked. Moreover, with the use of prosections becoming a popular alternative, systematic techniques for prosection are needed to maximize their efficient utilization. Here, we present a detailed technique for preparation of a multipurpose cadaveric prosection with conserved anatomical relationships for use in demonstrating surface and gross anatomy.

KEY WORDS: Dissection, Prosection, Gross anatomy, Integrated curriculum, Medical education.

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INTRODUCTION

Anatomy is considered to be the cornerstone of medicine, as understanding the structure of the body is pertinent to the comprehension of other basic and clinical medical sciences [1]. Traditionally, cadaveric dissection had been the conventional method for delivering anatomy curricula in many medical schools [2]. It typically involved students dissecting cadavers to study the deep and superficial relationships between structures using dissection guides [3]. This usually took a substantial amount of time in the gross laboratory and required the guidance of an adequate number of anatomy faculty [3]. The process of dissection however enables students to have a clear three-dimensional image and experience of the structural organization of the human body with the opportunity to compare the normal versus pathological structures [4]. Nonetheless, medical education in the last two decades has evolved from a separate basic science and clinical science curriculum to an interdisciplinary integrated curriculum [5]. This drastically reduced the time allocated for anatomy education, and so hundreds of hours of explorative dissection was no longer realistic as a learning style for modern medical students [6]. Moreover, many universities have reduced or even abandoned cadaveric dissections altogether due to space constraints, limited faculty numbers, high financial cost, and access to donors [7,8], replacing them with plastic models, simulators, 3D computer software and even virtual reality. These however cannot accurately portray the anatomical variations and pathologies present in the living population [6,9].

Different teaching methodologies have also been developed to promote the inclusion of prosections into the curricula to effectively display the relevant structures to their students. Subsequently, several studies have indicated that students learn equivalently from prosected specimens as dissections given that it involves the same level of interaction to mentally engage the students, but without the long and laborious hours spent in carrying out the dissection [10]. Furthermore, the use of prosections is easily adaptable to the flipped classroom models of anatomy education and integrated curriculum in general, where the students can independently get a good grasp of the material, making available more time to be devoted to clinical application and discussion [11]. With the use of prosections gaining more popularity in many medical schools, there is need for optimization of available resources. This article gives a stepwise guide to achieving a multi-purpose cadaveric prosection with intact anatomical relationships for use in teaching thoracic, and abdominal and pelvic anatomy.

MATERIALS AND METHODS

This dissection technique was utilized in the structure laboratory of the Donald and Barbara Zucker School of Medicine at Hofstra/Northwell to prepare multi-purpose surface anatomy prosections used in a longitudinal structure course for the first-year medical students. This research was deemed exempt from review by the Institutional Review Board (IRB) of Hofstra University. The authors hereby confirm that every effort was made to comply with all local and international ethical guidelines and laws concerning the use of human cadaveric donors in anatomical research.

Dissecting Instruments: The dissection tools that were employed in this technique included: Scalpel handle, blades, tissue forceps, tweezer forceps, pean forceps, iris scissors, dissecting scissors, bone shears.

Description of Technique: Make a full skin thickness incision using a scalpel, just superior to the pubic bone (A). Follow the line of the inguinal ligament to the anterior superior iliac spine (B), making sure not to pierce the delicate musculature of the lower anterior abdominal wall. Continue the incision to the midaxillary line (C) and continue superiorly until you arrive at the deltopectoral groove (D). Follow the grove and then arch the cut towards the midline along the inferior part of the clavicle. End the incision at the sternoclavicular junction (E) and repeat on the opposing side, connecting them just superior to the pubic symphysis, as shown in Figure 1.

Following conclusion of the major skin incisions, commence the careful detachment of the skin as a single sheet. Beginning at the pubic end, lift the dermis and subcutaneous fat using tweezer or pean forceps, and separate it from the abdominal muscular wall using the scalpel. This fascial plane should easily separate. Make a circular incision around the umbilicus approximately 2-3cm from the center so the skin will separate cleanly from the muscular wall without perforating as shown by the arrow shown in Figure 2. Extend the separation of the fascial planes to the sternal notch. The skin layer should now be freely mobile to reflect superiorly, attached only by the 6-8cm span between the clavicular heads. Use the tissue forceps and scalpel or iris scissors to remove soft tissues from the surface of the pectoralis major (A) and external oblique muscles (D), and clearly outline their borders. Subsequently, detach the pectoralis major from the clavicle, sternum, and costal cartilages of the ribs, while preserving their connection to the medial and lateral pectoral vessels and nerves and reflect it laterally. Also reflect the pectoralis minor muscle (B) laterally by detaching it from the ribs to reveal the intercostal muscles (C) as shown in Figure 2.

Beginning at the midaxillary line, just inferior to the 11-12th rib, make an incision with a scalpel or dissecting scissors going inferiorly towards the anterior superior iliac spine. Be cautious not to cut through the underlying bowels. Continue the cut towards the pubic bone and end approximately 4cm from the pubic symphysis. Going back to the midaxillary line, use bone shears to clip the ribs along the same guiding cut made by removing the skin. After clipping the second rib, separate soft

tissue deep to the clavicle and cut that bone as well, approximately 2 cm from the head. Arrows indicating lines of incision are shown in Figure 3. Clear the soft tissue connections from the sternal notch and repeat all steps on the opposite side. Detach the falciform ligament from the anterior abdominal wall. The anterior thoracic and abdominal wall should now be free and mobile as shown in Figure 4.

Additional Dissection: Using a scalpel, make two parallel cuts following the muscle striations of external oblique approximately 8 cm long and about the same distance apart 2cm from the midaxillary incision, just superior to the anterior superior iliac spine. Ensure to only go through the external oblique (A), then make a horizontal incision to connect these cuts. Repeat the cuts on the internal oblique (B) but leave transversus abdominus (C) untouched. You have now created an interlacing booklet displaying the three abdominal wall muscles as shown in Figure 5.

Subsequently, make a vertical incision on the anterior rectus sheath about 1cm lateral to the Linea alba beginning just below the costal angle to the superior border of the pubis. Reflect the anterior rectus sheath (A) laterally to expose the rectus abdominus muscle (B) by making horizontal incisions along the costal angle and superior pubis as shown in Figure 6.

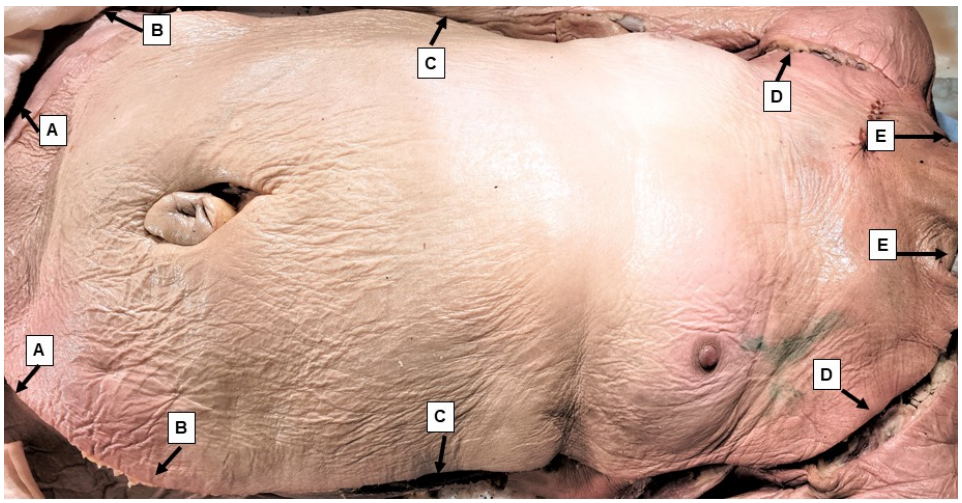

Fig. 1: Showing skin incisions from (A) superior to the pubic bone through the (B) anterior superior iliac spine, (C) midaxillary line, (D) deltopectoral groove and end at the (E) sternoclavicular joint.

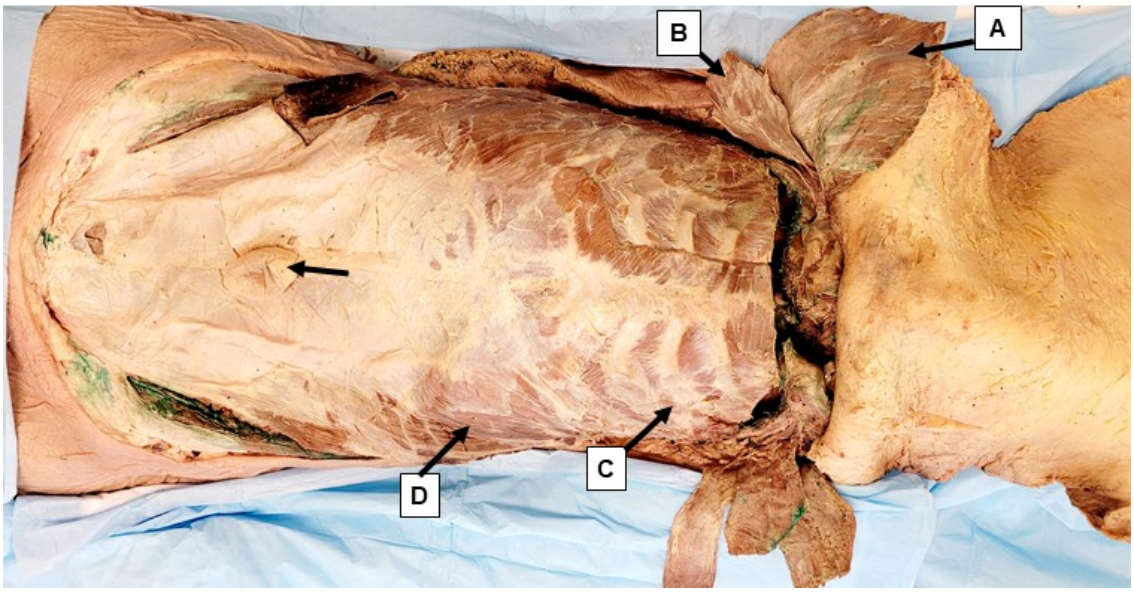

Fig. 2: Showing the skin reflected to reveal muscles of the thoracic and abdominal wall. (A) Pectoralis major, (B) Pectoralis minor, (C) Intercostal and (D) External oblique muscles.

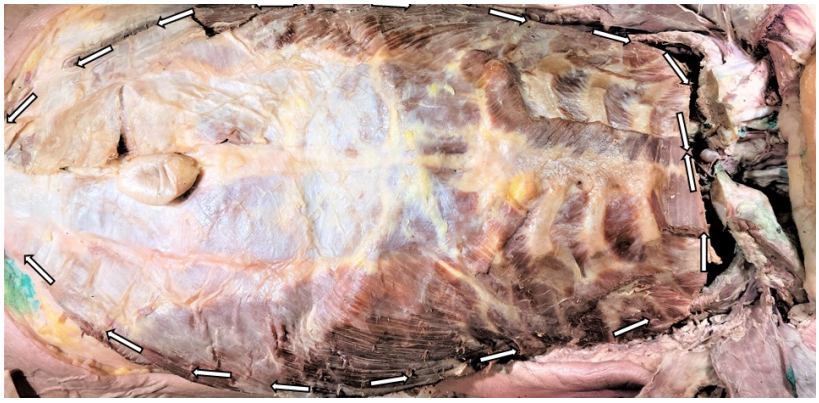

Fig. 3: Arrows showing pattern of second lines of incision.

Fig. 4: Showing the thoracic and abdominal wall reflected to reveal the thoraco-abdominal cavity.

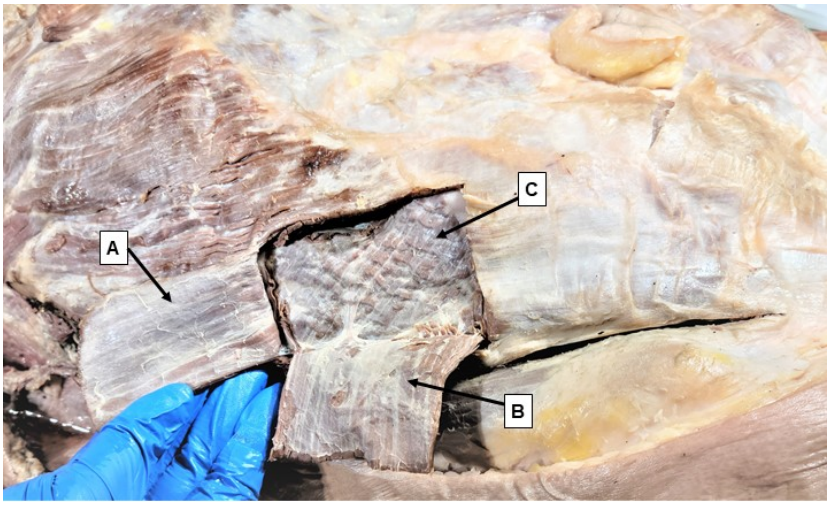

Fig. 5: Showing an interlacing booklet display of the anterolateral abdominal wall muscles. (A) External oblique, (B) Internal oblique, (C) Tranversus abdominis.

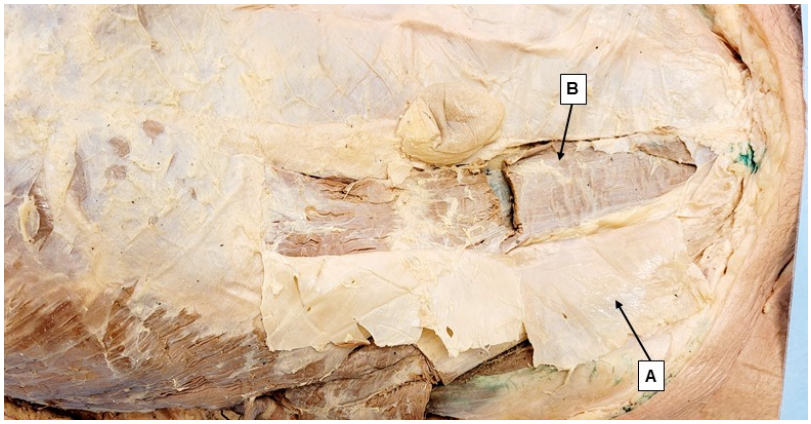

Fig. 6: Showing opening of the (A) anterior rectus sheath to reveal (B) rectus abominis muscle.

DISCUSSION

In this paper, we describe a technique for a multi-purpose cadaveric prosection which can be used in teaching thoracic, abdominal, and pelvic anatomy. The technique ensures access to deeper structures while preserving the skin and this serves as a useful tool for the study of surface anatomy. Incorporation of surface anatomy in undergraduate medical curriculum is essential for identification of thoracic landmarks and as an anatomical basis for clinical examination of the cardiovascular, respiratory, abdominal, and urogenital systems [12,13]. Beyond surface anatomy, this prosection allows for visualization of muscles of the thoracic and anterolateral abdominal wall and access into the thoracoabdominal cavity. Although not described in this paper, the lungs can be detached at the hilum to allow for dissection of the posterior thoracic wall and visualization of contents of the posterior mediastinum. The heart can also be detached from the inferior vena cava and the pericardium opened, hence making the heart more mobile for further exploration of its connections and relationships. Based on preference, one half of the upper and lower extremities can also be prosected for use in study of musculoskeletal anatomy while the other half can be preserved to study surface markings, including pulse points. Although this technique does not negate the need for dissection in the anatomy curriculum, it serves as a useful supplement for many medical schools that have evolved to organ-system based or case-based curricula as it also allows for the tactile understanding and three-dimensional visualization of the human body that is obtainable with the dissection experience [14].

CONCLUSION

The systematic approach to preparation of multipurpose prosections will maximize their use in anatomy curriculum for undergraduate medical education.

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Conflicts of Interests: The authors declare that they have no conflict of interest.

REFERENCES

[1]. Cotter JRC, Christopher S. The Timing, Format and Role of Anatomical Sciences in Medical Education. Medical Science Educator; 2010. p. 276-9.

[2]. Ghosh SK. Cadaveric dissection as an educational tool for anatomical sciences in the 21st century. Anat Sci Educ. 2017;10(3):286-99. Epub 20160830. doi: 10.1002/ase.1649. PubMed PMID: 27574911.

[3]. Wisco JJ, Young S, Rabedeaux P, Lerner SD, Wimmers PF, Byus C, et al. Student Perceived Value of Anatomy Pedagogy, Part I: Prosection or Dissection? J Med Educ Curric Dev. 2015;2. Epub 20150226. doi: 10.4137/JMECD.S17496. PubMed PMID: 35187248; PubMed Central PMCID: PMC8855374.

[4]. Dissabandara LO, Nirthanan SN, Khoo TK, Tedman R. Role of cadaveric dissections in modern medical curricula: a study on student perceptions. Anat Cell Biol. 2015;48(3):205-12. Epub 20150922. doi: 10.5115/acb.2015.48.3.205. PubMed PMID: 26417481; PubMed Central PMCID: PMC4582164.

[5]. Drake RL, McBride JM, Lachman N, Pawlina W. Medical education in the anatomical sciences: the winds of change continue to blow. Anat Sci Educ. 2009;2(6):253-9. doi: 10.1002/ase.117. PubMed PMID: 19890982.

[6]. Sugand K, Abrahams P, Khurana A. The anatomy of anatomy: A review for its modernization. Anatomical Sciences Education. 2010:NA-NA. doi: 10.1002/ase.139.

[7]. Jeyakumar A, Dissanayake B, Dissabandara L. Dissection in the Modern Medical Curriculum: An Exploration into Student Perception and Adaptions for the Future. Anat Sci Educ. 2020;13(3):366-80. Epub 20190711. doi: 10.1002/ase.1905. PubMed PMID: 31168930.

[8]. Estai M, Bunt S. Best teaching practices in anatomy education: A critical review. Ann Anat. 2016;208:151-7. Epub 20160317. doi: 10.1016/j.aanat.2016.02.010. PubMed PMID: 26996541.

[9]. Longhurst GJ, Stone DM, Dulohery K, Scully D, Campbell T, Smith CF. Strength, Weakness, Opportunity, Threat (SWOT) Analysis of the Adaptations to Anatomical Education in the United Kingdom and Republic of Ireland in Response to the Covid-19 Pandemic. Anat Sci Educ. 2020;13(3):301-11. Epub 20200509. doi: 10.1002/ase.1967. PubMed PMID: 32306550; PubMed Central PMCID: PMC7264742.

[10]. Wilson AB, Miller CH, Klein BA, Taylor MA, Goodwin M, Boyle EK, et al. A meta-analysis of anatomy laboratory pedagogies. Clin Anat. 2018;31(1):122-33. Epub 20170706. doi: 10.1002/ca.22934. PubMed PMID: 28612403.

[11]. Persky AM, McLaughlin JE. The Flipped Classroom - From Theory to Practice in Health Professional Education. Am J Pharm Educ. 2017;81(6):118. doi: 10.5688/ajpe816118. PubMed PMID: 28970619; PubMed Central PMCID: PMC5607728.

[12]. Smith SE, Darling GE. Surface anatomy and surface landmarks for thoracic surgery: Part II. Thorac Surg Clin. 2011;21(2):139-55, vii. doi: 10.1016/j.thorsurg.2011.01.004. PubMed PMID: 21477763.

[13]. Boon JM, Meiring JH, Richards PA. Clinical anatomy as the basis for clinical examination: development and evaluation of an Introduction to Clinical Examination in a problem-oriented medical curriculum. Clin Anat. 2002;15(1):45-50. doi: 10.1002/ca.1091. PubMed PMID: 11835544.

[14]. Gregory SR, Cole TR. MSJAMA. The changing role of dissection in medical education. JAMA. 2002;287(9):1180-1. PubMed PMID: 11879120.

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