A Simple and Effective Way to Teach the Clinical Importance of the Perineal Body

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Abstract
The perineal body is located where four muscles (the superficial anal sphincter, the bulbospongiosus and both superficial transverse perineal muscles) have a common insertion at a nondescript point between the vagina or penile bulb and the anus. Health professions students have difficulty identifying its location and do not have a full appreciation of its function. Clinically, it provides support for the pelvic organs, especially in women. To help clarify the function of the perineal body, a demonstration can be performed which uses three student volunteers and a faculty member. By using one of their hands to represent the perineal muscles, a "perineal body" can be formed. As each person pulls in their respective direction, tension on the "perineal body" is formed; illustrating the concept that the perineal body provides pelvic organ support. During the demonstration, the faculty member discusses the clinical importance of the perineal body. The whole high yield demonstration takes less than two minutes to complete. https://doi.org/0.21692/haps.2019.023

Key Words: perineal body, medical education, gross anatomy, health professions, obstetrics, gynecology

Introduction
The pelvis and perineum are difficult regions to dissect and it is a challenge for health professions students to gain a 3-D appreciation of the organization of this area. This is compounded by the fact the region is also sexually dimorphic. It has been shown that 47% of fourth year Ob/Gyn residents and 40% of Ob/Gyn fellows lack an appropriate understanding of pelvic and perineal neurovasculature, tissue planes, and muscular insertions and origins (Advolodkina and Chahine 2017; Doo et al. 2015). If physicians in advanced OB/Gyn training have difficulty, then health professions students taking an anatomy course for the first time, by extension, would most likely have even greater difficulty comprehending the 3-D aspects of pelvic and perineal anatomy.

Within the perineum, health professions students often find the perineal body to be an enigma that is difficult to conceptualize. Even during dissection on whole or hemisected cadavers, where the perineal body is revealed, it is a somewhat nondescript point. This is frustrating to students who expect to see a clearly defined structure, as it is often shown in anatomy atlases and textbooks (Drake et al. 2015; Netter 2019). Atlases and textbooks typically show the perineal body as a fibrous point of insertion for many of the muscles in the urogenital and anal triangles such as the left and right superficial transverse perineal muscles, the superficial part of the external anal sphincter, and the bulbospongiosus muscle, which is cleft in females (Figure 1) but fused along a midline raphe in males. In reality, the muscles of this region have a complex embryological development which results in variations influencing whether they do, or do not, insert on the perineal body (Peikert et al. 2015; Plochocki et al. 2016; Shafik et al. 2007).

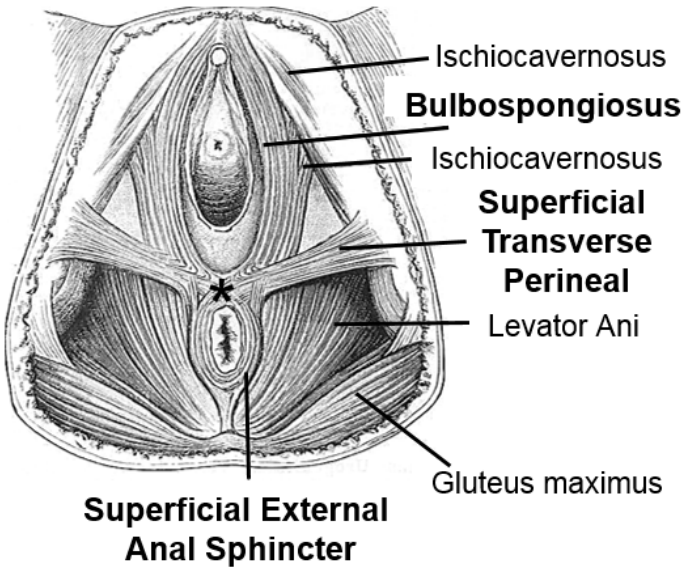

Figure 1. *Female perineum with the muscles contributing to the perineal body (asterisk) in bold type. In females, the bulbospongiosus muscle is cleft and surrounds the vaginal vestibule; in males it is fused along a midline raphe. The right and left superficial transverse perineal muscles are found along the posterior edge of the perineal membrane. Image acquired from open knowledge commons use, and slightly modified, from the 1914 Cunningham's text-book of anatomy.*

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When asked by an instructor, many students can state which muscles insert on the perineal body and can deliver a rudimentary understanding of the clinical importance of this region. However, it is the author's experience from over 32 years teaching gross anatomy that few students have a true appreciation and/or understanding for how the perineal body is formed and how it helps to support the pelvic viscera, especially in females. One way to overcome this difficulty in studying perineal anatomy is to use a variety of teaching techniques utilizing the various learning methods preferred by students. Quinn and colleagues (2018) show that the use of active learning combined with sensing, visual, motor, and sequential styles of learning (blended learning) all help to reinforce the ability of students to understand anatomy. For example, visual aids using your fingers, blankets, or movable 3-D models have been used in the past to help teach students cranial neve functions, abdominal arterial supply, pelvic peritoneal reflections, and knee joint morphology (Cai et al. 2019; Dickson and Stephens 2015; Khalil et al. 2018; Nayak 2006; Oh et al. 2011). Furthermore, having students work in teams or groups has also been proven to be an effective way for students to learn anatomy (Shaffer 2016).

In order to help medical students or health professions students gain a better understanding of the perineal body and its function, the author has developed a simple demonstration utilizing all of the aforementioned learning techniques/styles. This demonstration is a hands-on, team-based method, using sensing, visual, motor, and sequential styles of learning. Since the demonstration is face-to-face, the instructor can gauge student understanding and immediately correct any misconceptions.

Methods

The demonstration requires one instructor and three student volunteers. If the demonstration takes place in the gross anatomy laboratory, it is easy to gather three students from one or more neighboring dissection tables to participate. Before the demonstration begins, ask the students to point out the perineal body on a cadaver or pelvic model. Then ask the students which muscles insert on the perineal body. To begin the actual demonstration, have two students stand opposite each other as the east and west compass points to represent the superficial transverse perineal muscles. Each student extends one hand to grasp the hand of the other student (Figure 2). Another student, as the north compass point, extends one hand and grasps the top of other two hands to represent both halves of the bulbospongiosus muscle (Figure 3). Representing the superficial portion of the external anal sphincter, the instructor, as the south compass point, grasps the other three hands from underneath (Figure 3).

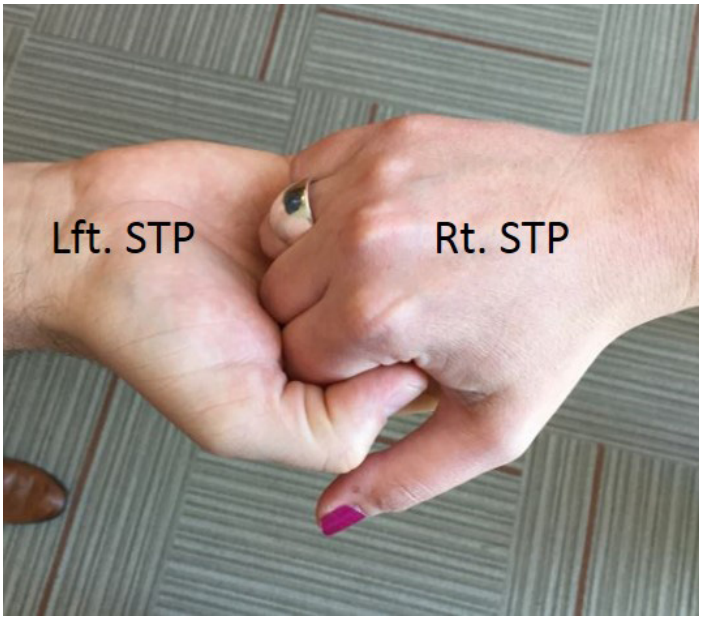

Figure 2. *The two hands represent the right and left superficial transverse perineal muscles (Rt. STP and Lft. STP, respectively). Where they are grasped together represents the initial formation of the "perineal body".*

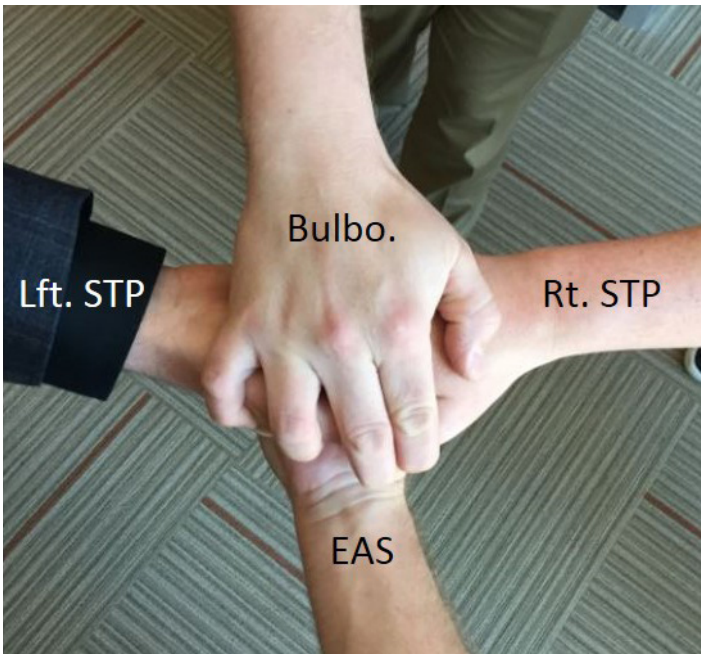

Figure 3. *The top hand is grasping the two superficial transverse perineal muscles, and represents the right and left halves of the bulbospongiosus muscles (Bulbo). The bottom hand, holding the other three hands, represents the superficial external anal sphincter (EAS). The entire "perineal body" is now formed.*

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As each student extends a hand, the instructor tells each student what muscle he or she represents and that the combined hands are forming a perineal body. While forming the perineal body, it is important that the four individuals be close enough together so their arms are not fully extended. Also inform the students the male bulbospongiosus muscle is in two halves joined at a raphe, while the female bulbospongiosus muscle remains cleft with the posterior aspect of each half inserting on the perineal body (Figure 1).

Once all hands are clasped together, have each person pulls in their respective direction. This will cause the newly formed "perineal body" to stiffen. In order to enhance the illusion of how the perineal body helps to support the pelvic organs, the instructor, who represents the superficial external anal sphincter, and has his or her hand underneath the other three, can push slightly upward. When the "perineal body" is stiffened, the instructor then speaks about the clinical importance of how the perineal body is important for preventing pelvic organ prolapse. The entire demonstration can take place in two minutes or less.

Results

Many health professions students come away with a better understanding of how the perineal body functions to support pelvic organs and prevent pelvic organ prolapse. Unsolicited student comments to the instructors, after seeing the demonstration either at the allopathic medical school in Arkansas, or the osteopathic medical school in North Carolina, were positive and expressed how they now had a much better grasp of perineal body formation and its clinical importance. The anatomy faculty at both medical schools noted a reduction in student misconceptions about the anatomy of the perineal region. As further proof of the usefulness of this demonstration, students who have participated in the demonstration often show it to their peers along with discussing its clinical relevance.

Discussion

This is a simple, effective way to show how the perineal body is formed and functions. Although the students may be initially reticent to participate, it does not take much cajoling to have them volunteer, especially if you tell them it will be "high yield". Using this phrase catches the attention of students, since they themselves use it to describe basic science content they feel is essential to learn for national board exams such as the allopathic USMLE or the osteopathic COMLEX exams. Another way the demonstration can be memorable, is to make sure the instructor always represents the external anal sphincter. Not only does this avoid inferring one of the students is a "less than desirable" part of the anatomy, it has never failed to elicit laughter for the 27 years the author has been doing this demonstration when you say, "I know no student wants to be the external anal sphincter, so that's always me." The author has had students who are no longer in the gross anatomy course come back and ask if the perineal body demonstrations are still being used. This attests to the positive impact this simple demonstration has made on health professions students to help them remember the clinical importance of the perineal body.

In order to impart the clinical importance of the perineal body, several examples can be mentioned after the physical aspect of the demonstration is over. Emphasizing the importance of keeping the perineal body intact during labor and delivery for the prevention of pelvic organ prolapse and incontinence is essential (Plochocki et al. 2016; Woodman and Graney 2002). Information concerning the placement of an episiotomy in order to prevent an uncontrolled laceration through the perineal body (potentially into the anorectal junction), and which structures are cut via a midline vs. a mediolateral incision, needs to be included in the discussion (Table 2 Woodman and Graney 2002). At the same time, the students can be informed that stretching of the perineal body, which occurs normally during labor, does not impair the function of the perineal body regarding pelvic organ support or incontinence (Meriwether et al. 2016). Concerning males, the importance of keeping the anatomy of the perineal body intact during prostate or anorectal surgery in order to help avoid impotence and incontinence can be mentioned (Kraima et al. 2015).

Conclusion

In conclusion, descriptions of the anatomy of the anal and urogenital triangles in most texts and atlases show the "classic" relationship of the perineal muscles with the perineal body; however, these are inaccurate (Drake et al. 2015; Netter 2019). Nevertheless, although they may be inaccurate, this does not detract from the clinical relevance of this structure, regardless of how many of the perineal muscles do, or do not, directly insert on the perineal body (Kraima et al. 2015; Plochocki et al. 2016; Shafik et al. 2007). Considering an undergraduate medical education should be generalized (we are not teaching the students to be anatomists or surgeons), the anatomy atlas or text that shows a classical representation of the perineal body and the muscles that "insert" into it suffices. The detailed specifics of the perineal musculature and their variations, insertions and neurovasculature can be learned during postgraduate training such as during Ob/Gyn, urology or other pertinent surgical residencies.

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Usefulness to Anatomy and Physiology Instructors

This brief demonstration is easy to learn and it can be performed in less than two minutes. It illustrates to health professions students how the perineal body is formed and its importance in supporting pelvic organs, especially in women. The demonstration can be performed in a gross anatomy laboratory setting as well as in a lecture hall. It has proved to be effective in the education of medical, physician assistant, physical therapy and graduate students.

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