Normal Vulvovaginal, Perineal, and Pelvic Anatomy with Reconstructive Considerations

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ABSTRACT

A thorough insight into the female genital anatomy is crucial for understanding and performing pelvic reconstructive procedures. The intimate relationship between the genitalia and the muscles, ligaments, and fascia that provide support is complex, but critical to restore during surgery for correction of prolapse or aesthetic reasons. The external female genitalia include the mons pubis, labia majora and minora, clitoris, vestibule with glands, perineal body, and the muscles and fascia surrounding these structures. Through the perineal membrane and the perineal body, these superficial vulvar structures are structurally related to the deep pelvic muscle levator ani with its fascia. The levator ani forms the pelvic floor with the coccygeus muscle and provides vital support to all the pelvic organs and stability to the perineum. The internal female genital organs include the vagina, cervix, uterus, tubes, and ovaries with their visceral fascia. The visceral fascia also called the endopelvic fascia, surrounds the pelvic organs and connects them to the pelvic walls. It is continuous with the paraurethral and paravaginal fascia, which is attached to the perineal membrane. Thus, the internal and external genitalia are closely related to the muscles and fascia, and work as one functioning unit.

KEYWORDS: Female external genitalia, endopelvic fascia, perineal membrane, levator ani, clitoris, labia majora, labia minora

The complexity of the pelvic floor, how it supports the pelvic organs, and the relationship of the external genitalia to the fascia and muscles make the anatomy of the female pelvis intriguing. Understanding normal female anatomy is crucial in the development of reconstructive procedures for the correction of anatomic defects. The external genitalia formed by the mons, labia majora, labia minora, clitoris and the perineum are supported by the superficial and deep muscles of the perineum and pelvis and their fascia.^{1,2} The internal

female genitalia consist of the uterus, fallopian tubes, and ovaries, along with the connective tissue supports of the fascia, muscles, and ligaments. The plastic surgeon deals with reconstructive surgeries of the vulva and the vagina, sex reassignment procedures, and skin grafts after treatment of local pathology. Especially with increasing demand for labioplasty, vaginoplasty and vaginal rejuvenation, justification for surgery with understanding of normal versus abnormal is fundamental. It is imperative to have a complete knowledge of local anatomy to avoid

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inadvertent injury to neurovascular structures and to obtain an optimal outcome.

The uterus, cervix, fallopian tubes, and ovaries lie within this bony pelvis and are connected to the exterior via the vagina. The vagina along with the urethra and rectum pass through the pelvic diaphragm formed by the levator ani muscle to open into the vestibule. The vestibule is surrounded by the labia minora and majora on each side and is limited by the perineal body posteriorly. The perineal body is the meeting point of several superficial perineal muscles, fibers of the levator ani, and the perineal membrane bringing stability to the area. The perineal membrane is a triangular fibromuscular structure that expands from the ischial tuberosities laterally to the pubic bone anteriorly. Cadaveric and advanced magnetic resonance imaging (MRI) studies have greatly helped us understand the female genital anatomy, anatomic variations, and role of the levator ani in pelvic support.

BONY PELVIS

The human bony pelvis is formed by two innominate bones. Each innominate or hip bone is formed by the fusion of the ilium, ischium, and the pubis. The hip bones from each side articulate anteriorly at pubic symphysis and posteriorly with the sacrum to form a girdle. Each innominate bone on its lateral surface has an acetabulum, which articulates with the femoral head. Anteroinferior to the acetabulum is the obturator foramen, which is formed by ischium and pubis and covered by the obturator membrane.

The pubis is the ventral part of the innominate bone and forms a median cartilaginous pubic symphysis with its counterpart. From its anteromedial body a superior ramus passes up and back to the acetabulum and an inferior ramus passes back, down and laterally to join the ischial ramus inferomedial to the obturator foramen.

The ilium has upper and lower parts and three surfaces. The smaller, lower part forms the upper two-fifths of the acetabulum. The upper part is much expanded, and is defined by the gluteal, sacropelvic, and iliac (internal) surfaces. The posterolateral gluteal surface is an extensive rough area; the anteromedial iliac fossa is smooth and concave; the sacropelvic surface is medial and posteroinferior to the fossa, from which it is separated by the medial border.

The ischium, the inferoposterior part of the innominate bone, has a body and ramus. The body has upper and lower ends and femoral, posterior, and pelvic surfaces. Above, it forms the inferoposterior part of the acetabulum; below, its ramus ascends anteromedially at an acute angle to meet the descending pubic ramus and complete the obturator foramen. The ischiofemoral ligament is attached to the lateral border below the

acetabulum. The periosteum of these bones derives neurovascular supply from the vessels and nerves that supply the attached muscles and joints.

EXTERNAL GENITALIA

External genitalia, also called the vulva, consist of the mons pubis, clitoris, labia minora, labia majora, and the vestibule with the external urethral meatus, vaginal orifice, and the vestibular bulbs and glands (Fig. 1). The remnants of hymen surround the vaginal opening. The blood supply is through multiple collaterals from the internal and external pudendal artery.

Mons Pubis

The mons pubis is a triangular area of fatty tissue, covered with hair-bearing skin lying on top of the pubic bone. It is an inverted triangle that extends from the glans clitoris inferiorly to the pubic hairline, which forms the base of this triangle. Its substance consists of loose adipose tissue overlying fascia, which is a continuation of the Colles and Scarpa's fascia from the anterior abdominal wall. The average length of the base was found to be 16 ± 2 cm and the height of the triangle 13 ± 2 cm in 15 healthy women and 13 cadavers between ages 26–95.³ The measurements were dependent on the body size, age, and weight. These normal averages may provide a reference point during abdominoplasty and other surgeries.

Labia Majora

The labia majora are prominent cutaneous folds located between the mons pubis and the perineum mainly consisting of adipose tissue, hair follicles, and sebaceous glands. They unite anteriorly to form the anterior commissure of the labia majora and posteriorly fuse with the surrounding tissues to form the posterior commissure. The outer surfaces of the lips of labia majora in the adult are covered with pigmented skin

Figure 1 Female external genitalia.

containing many glands and are covered with curly pubic hair. The insides of the labia are smooth, pink, and hairless. Labia majora resemble the anterior abdominal wall in structure. Camper's fascia with predominance of fat is superficially located. The thicker Colles fascia forms the deeper layer and corresponds to the Scarpa's fascia in the abdominal wall. The Colles fascia is inferiorly attached to the ischiopubic rami, posteriorly to the urogenital diaphragm, but lacks anterior attachment. This prevents spread of hematomas and infections to the thigh, but spread can occur to the anterior abdominal wall. The round ligament of the uterus and the obliterated processus vaginalis terminate in the labia majora. Labial enlargement due to labia majora hypertrophy has been well described in literature with surgical reconstruction and successful results.⁴

Labia Minora

The labia minora are folds of skin, devoid of fat, rich in sebaceous glands lying medial to the labia majora on each side immediately adjacent to the vestibule. There is a core of connective tissue and vascular erectile tissue with sensory nerve endings to which they are loosely attached. Each labia minora splits anteriorly around the clitoris, uniting with the labia minora from the contralateral side to form the prepuce over and frenulum under the clitoris. There is large variation in the dimensions of the labia minora. Lloyd et al in their study of 50 premenopausal women between ages 18–50 years found the average length of labia minora to be $6.0 \text{ cm} \pm 1.7$ (2–10) and average width to be $2.1 \text{ cm} \pm 0.9$ (0.7–5).⁵ Maximum distance from the base to the edge $> 4 \text{ cm}$ is considered criteria for corrective surgery by most plastic surgery literature.^{6,7} There is a great diversity and variation with the size of the labia minora that surgeons need to be aware of and consider before planning corrective surgery.

Clitoris

The clitoris is a highly neurovascular erectile structure, embryologically derived from undifferentiated phallus and consists of the paired corpora, vestibular bulbs, and the glans. The corpora diverge to form the crura on each side along the ischiopubic rami.⁹ The glans is the most richly innervated part of the clitoris. Magnetic resonance imaging and cadaveric studies have helped us better understand the detailed structure of the clitoris.¹⁰ The clitoris plays a major role in female sexual function and is very closely related to the distal urethra and vagina.¹¹

The clitoris is suspended by the superficial and deep suspensory ligaments as described by Rees.¹² Based on cadaveric dissections they found the superficial suspensory ligament to be attached to the deep fascia of the mons and glans and body of the clitoris further extending

into the labia majora. The deep suspensory ligament originates from the symphysis pubis and attaches to the body, bulbs, and glans of the clitoris. These may provide clitoral stability during sexual intercourse. Accurate knowledge of the clitoris, its relations, and neurovascular supply is crucial in performing clitoral reduction for clitoromegaly to achieve normal morphology without affecting sexual function. It is important to preserve the bulbs with the erectile tissue related closely to the ventral aspect of the clitoris for sexual function, and suspensory ligaments to maintain the anatomic position of the clitoris during surgery.^{13–15}

Vestibule

An area extending from the clitoris to the posterior fourchette lying between the two labia minora is called the vestibule. It contains the vaginal orifice, external urethral meatus, vestibular bulbs, the openings of the two greater vestibular glands and those of numerous, mucous, lesser vestibular glands. There is a shallow vestibular fossa between the vaginal orifice and the frenulum of the labia minora.¹ The bulbs of the vestibule are paired elongated masses of erectile tissue, measuring $\sim 3 \text{ cm}$ in length located along the sides of the vaginal ostium under the cover of bulbospongiosus muscles. The greater vestibular glands (Bartholin's glands) are two small structures on either side of the vaginal ostium with openings through ducts $\sim 2 \text{ cm}$ in length, in the groove between the hymen and the labia minora.

Neurovascular Supply of External Genitalia

Arterial supply of the vulva is derived from the external and the internal pudendal arteries on each side. The internal pudendal artery is a branch of the anterior division of the internal iliac artery and the vein drains into the internal iliac vein. The vessels follow the course of the pudendal nerve and supply the superficial perineal muscles and the external genitalia via different branches. The inferior rectal artery supplies the anal canal; the perineal artery supplies the superficial perineal muscles, posterior labial branch, artery to the bulb of the vestibule, dorsal and deep arteries of the clitoris; and the urethral artery supplies the respective structures. The superficial and deep external pudendal arteries are branches of the femoral artery; they distribute into the labia majora and anastomose with branches of the internal pudendal artery. There is a network of anastomosis between branches of these arteries throughout the female external genitalia.¹⁶

The pudendal nerve is the main sensory and motor nerve of the perineum. It arises from the ventral rami of S2–S4, runs underneath the piriformis, and exits the pelvis through the greater sciatic foramen. It passes just behind the ischial spine and reenters the pelvis

through the lesser sciatic foramen. The pudendal nerve then runs in the Alcock's canal (pudendal canal) in the obturator fascia and ventral to the sacrotuberous ligament.^{17,18} As it enters the perineum, the pudendal nerve lies on the lateral wall of the ischiorectal fossa and divides into three branches: the inferior rectal, perineal, and dorsal nerve of the clitoris.¹⁹ The dorsal nerve of the clitoris lies on the perineal membrane along the ischiopubic ramus and on the anterolateral surface of the clitoris, one on each side, and supplies the clitoris.¹²

The perineal nerve divides into several branches and supplies the bulbocavernosus, ischiocavernosus, superficial transverse perineal muscles, and the skin of the medial portion of labia majora, labia minora, and vestibule. The inferior rectal nerve supplies the perianal skin and the external anal sphincter. In addition to the branches of the pudendal nerve, innervation is also supplied by the cutaneous branch of the ilioinguinal nerve, the genital branch of genitofemoral nerve, and the perineal branch of the posterior femoral cutaneous nerve. Additional branches including the nerve to the levator ani and the accessory nerve to the perineal muscles and perianal skin have been reported by different authors.¹⁷

INTERNAL GENITALIA

Vagina

The vagina is a fibromuscular tubular structure that extends from the cervix to the vulva and measures 7–9 cm in length. Embryologically, the upper two-thirds is derived from the paramesonephric duct and the lower third from the urogenital sinus. The upper two-thirds lies horizontal while the lower third lies vertically with the woman in an upright position. The walls of the vagina are covered with rugae, which are epithelial ridges for stretching and expansion. Normally, the vaginal walls are collapsed and in contact except at the upper end where the cervix keeps them separate. The annular recess between the cervix and vagina forms four fornices: the anterior, posterior, and two lateral. The posterior fornix is deeper and is closely related to the rectouterine pouch. The vagina is related anteriorly to the base of urinary bladder and urethra, laterally to the levator ani muscle and endopelvic fascia, and posteriorly to the perineal body, anal canal, rectum, and rectouterine pouch.

The vaginal wall consists of three layers. The inner mucosal layer consisting of nonkeratinized stratified squamous epithelium on a layer of loose vascular connective tissue called lamina propria; a middle muscular layer of smooth muscle, collagen, and elastin; and an outer adventitial layer of collagen and elastin with neurovascular bundle and lymphatics. Research has failed to identify a true fascial layer of collagen and

elastin between the vagina and bladder anteriorly and rectum posteriorly.

The vaginal walls lack glands and most of the lubrication is provided by transudation from the vessels in the vaginal wall, the cervical glands, and Bartholin and Skene glands. The tissue between bladder and urethra, and the anterior vaginal wall has historically been called the pubocervical fascia. Posteriorly the tissue between the posterior vaginal wall and rectum is called the rectovaginal septum. The presence of these fasciae has been questioned and histological studies have failed to identify these separate layers. The histology of the anterior and the posterior vaginal wall contains a muscularis layer and not a separate layer of fascia. A better terminology to define this surgical plane of dissection and repair is anterior and posterior vaginal muscularis or fibromuscular layer.²⁰

The distal vagina lies in close proximity to the urethra and clitoris and this relationship has been demonstrated well on MRI.^{10,21} These structures share the same blood supply and innervations.

The vaginal canal has various levels of support. Delancey, in his landmark cadaveric study, described the three levels of vaginal supports based on dissection of 61 cadavers.²² The level 1 support includes the uterosacral cardinal complex and suspends the upper 2–3 cm of the vagina to the sacrum and the pelvis sidewall. Level II support is comprised of the attachment of the lateral wall of the vagina to the arcus tendineus fasciae pelvis anteriorly and the levator ani fascia posteriorly. These thick tissue attachments are comprised of smooth muscle, collagen, and elastin along with the neurovascular bundle. The anterior attachment corresponds to the pubocervical fascia and posterior to the rectovaginal septum.

The terminal 2–3 cm of the vagina is fused to the structures around it without any suspensory ligaments. The level III support is thus provided by the adjacent structures it attaches to: anteriorly the urethra and the perineal membrane, posteriorly the perineum and the perineal body, and laterally to the levator ani. The three levels of support form one continuous support for the vagina and are interconnected together thereby working as one unit.

The arterial supply is through the descending branch of the uterine artery, vaginal artery, and internal pudendal artery, while the veins form the vaginal venous plexuses that ultimately drain into the internal iliac veins via the uterine vein. The upper two-thirds of the vagina has visceral innervation derived from the uterovaginal plexus and the lower one-third derives somatic innervations from the pudendal nerve.

Uterus

The uterus consists of the upper fibromuscular body and lower cervix, which primarily consists of fibrous

connective tissue. The uterus is connected to the lateral pelvic walls on both sides by two folds of peritoneum with loose areolar tissue called the broad ligament. The upper end of the broad ligament encases the fallopian tubes, round ligaments, uteroovarian ligaments, and the ovaries. Round ligaments extend from the lateral side of the uterine body, become retroperitoneal, and enter the internal inguinal ring lateral to the epigastric vessels. They traverse through the inguinal canal and exit the external inguinal ring to insert into the labia majora. They correspond to the gubernaculum testis in males. These connective tissue layers contain neurovascular bundles and serve no suspensory function.

Uterosacral ligaments provide support to the cervix and upper part of the vagina by their attachment to the sacrum. Attachment of the uterosacral ligament to the vaginal apex was first described by Miller in 1927.²³ This ligament can withstand 17 kg of weight before failing and thus forms an excellent surgical point of attachment for suspension during correction of prolapse.²⁴ Cardinal ligaments, also called the transverse cervical or Mackenrodt's ligament is a condensation of the pelvic connective tissue. These extend from the cervix to the posterolateral pelvic sidewall and support the uterus and cervix, as well as provide level 1 support to the upper 2–3 cm of the vagina along with the uterosacral ligament.

Fallopian Tubes and Ovaries

These are the adnexal structures located on each side of the uterus. The fallopian tubes are tubular structures lined with ciliated columnar epithelium extending from the upper lateral end of the uterus to the ovary on each side. Each fallopian tube can be divided into four anatomical parts: interstitial, isthmic, ampullary, and infundibulum with the fimbria. The vascular supply is via the mesosalpinx through branches of the ovarian artery as it runs in the broad ligament. The ovaries are oval-shaped structures lying in the lateral pelvic wall in the ovarian fossa. Each ovary consists of an inner medulla and an outer cortex with follicles and stroma. The ovaries are suspended from the broad ligament via the mesovarian, which completely covers them making them interperitoneal. The ovary is suspended from the uterus by the fibrous band called the uteroovarian ligament and from the pelvic sidewall by the infundibulopelvic ligament. The infundibulopelvic ligament contains loose connective tissue in addition to ovarian artery and vein, and the accompanying lymphatics and nerves, which supply the ovary.

FASCIA AND MUSCLES OF THE PELVIS

The pelvic floor is formed by the pelvic diaphragm consisting of the levator ani and the coccygeus muscles with their fasciae, and the perineal membrane with the

superficial and deep perineal muscles along with the perineal body.

Fascia

The two kinds of fascia in the body include the parietal and visceral fascia. The parietal fascia covers the skeletal muscles and the visceral fascia covers the body organs. Fascia is a loosely organized combination of elastin, collagen, adipose tissue, and neurovascular tissue. The endopelvic fascia is the condensation of the visceral fascia around the pelvic organs and connects these organs to the lateral pelvic wall. The paravaginal connective tissue that attaches the anterior vaginal wall to the arcus tendinous fascia pelvis and the posterior vaginal wall to the levator ani are considered an extension of the endopelvic fascia.

Muscles

The muscles arising within the pelvis form two groups. The levator ani and coccygeus muscles form the pelvic diaphragm with the urethra, vagina, and rectum passing through the urogenital hiatus, while the piriformis and obturator internus muscles form the lateral walls of the pelvis but functionally are muscles of the lower limb. The fascia covering the levator muscles is continuous with endopelvic fascia above, perineal fascia below, and obturator fascia laterally.

Thickening in the obturator fascia is called the arcus tendinous fascia pelvis and extends from the pubis anteriorly to the ischial spine and provides attachment to the paravaginal connective tissue. Arising from a similar location on the pubis but extending superior to the arcus tendinous fascia pelvis, is a thickening of levator ani fascia called arcus tendinous levator ani, which is the origin to the levator ani muscle.

Levator Ani

The levator ani muscle is the main structure providing pelvic organ support and forms an integral part of the pelvic floor. There has been recent progress in understanding this muscle due to advances in research incorporating MRI.²⁵ Magnetic resonance imaging has been instrumental in identifying the shape and function of the levator ani as well as in understanding the sites of injury.²⁶ Traditionally, levator ani is composed of three muscles: pubococcygeus, iliococcygeus, and puborectalis (Fig. 2). According to *Terminologia Anatomica*, the pubococcygeus muscle (pubovisceral) is further subdivided into the puboperinealis, pubovaginalis, and the puboanalis.^{27,28} The puboperinealis, pubovaginalis, and the puboanalis all originate on the inner side of the pubic bone on each side anteriorly and insert into the perineal body, vaginal wall (at the level of mid urethra), and into

Figure 2 Inferior view of pelvic floor muscles. (From: Schorge JO, et al. Williams Gynecology. New York: The McGraw-Hill Companies, Inc., Copyright © 2008, with permission.)

the intersphincteric groove between the internal and external anal sphincter in the anal skin, respectively. Their function is to elevate the respective structures and provide a constant tone to the pelvic floor.^{27,28}

The puborectalis originates from the pubic bone and forms a sling around the rectum, creating the anorectal angle, thus playing a role in the anal incontinence mechanism.^{27,28} The iliococcygeus originates from the arcus tendineus levator ani (tendinous arch of levator ani) and fuses with its counterpart in the anococcygeal raphe (levator plate) and forms a supportive diaphragm between the anus and the coccyx.^{27,28} Levator fascia covers the levator muscle on both sides and fuses inferiorly with the perineal membrane. The levator ani is supplied by branches of the inferior gluteal artery, the inferior vesical artery, and the pudendal artery. The innervation is from branches of ventral nerve roots of S2–S4.

Perineum

The perineum is a diamond-shaped area lying superficial to the perineal membrane and is bounded by the pubic symphysis, ischiopubic rami, sacrotuberous ligaments, and coccyx. It includes the vulva and the anus. An arbitrary line that passes between the two ischial tuberosities divides the perineum into two triangles: the anterior urogenital and the posterior anal triangle. The urogenital triangle located anteriorly, includes the female external genitalia, and is characterized by the perineal membrane, which divides it into superficial and deep perineal spaces. The anal triangle contains the anal orifice and posterior part of the perineum. Clinically,

perineum is a term used to describe the area between the vaginal introitus and the anus.

Perineal Membrane

The perineal membrane, formerly known as the urogenital diaphragm consists of dense fibromuscular tissue that attaches laterally to the ischiopubic rami, posteriorly to the perineal body, medially to lateral walls of the vagina and urethra and apically to the arcuate pubic ligament (Fig. 3). Oelrich in his pioneering article in 1983 defined the striated urogenital sphincter muscle of the female and disproved the presence of urogenital diaphragm being a closed space formed by deep transverse perineal muscle with a superior and inferior fascia.²⁹ In his study based on cadaveric dissections, he defined the female striated urogenital sphincter (formerly known as deep transverse perineal) to consist of sphincter urethrae, urethrovaginal sphincter, and compressor urethrae (Fig. 4). These muscles lie superior to the perineal membrane in the deep perineal space that is continuous with the pelvic cavity. The superior fascia of these muscles is continuous with the endopelvic fascia. The superficial perineal space lies between the perineal membrane and the subcutaneous tissues and contains the clitoris, bulbocavernosus (bulbospongiosus), ischiocavernosus muscles, and the vestibular bulbs.

The superficial Colles fascia of the urogenital triangle forms a clear, surgically recognizable plane beneath the skin of the anterior perineum. It is firmly attached posteriorly to the fascia over the superficial transverse perineal and the posterior limit of the perineal

Figure 3 Perineal structures and superficial perineal space. (From: Schorge JO, et al. Williams Gynecology. New York: The McGraw-Hill Companies, Inc., Copyright © 2008, with permission.)

membrane. Laterally, it is attached to the margins of the ischiopubic rami as far back as the ischial tuberosities. From here it runs more superficially to the skin of the urogenital triangle, lining the external genitalia before running anteriorly into the skin of the lower abdominal wall where it is continuous with the membranous Scarpa's fascia.²

The perineal membrane has been found to consist of ventral and dorsal components.³⁰ The ventral component is continuous with the paraurethral and paravaginal

connective tissues and arcus tendinous fascia pelvis. It provides attachment to the female striated urogenital sphincter muscles and the vestibular bulbs and clitoris fuse to its inferior surface. The dorsal component attaches laterally to the ischiopubic rami on each side, medially to the vagina and the perineal body. The levator ani muscle is attached to its superior surface and to the perineal body; this explains how disruption of the perineal body during childbirth can lead to separation of the perineal membrane, displacement of levator ani

Figure 4 Perineal structures found deep to perineal membrane. (From: Schorge JO, et al. Williams Gynecology. New York: The McGraw-Hill Companies, Inc., Copyright © 2008, with permission.)

and widening of the genital hiatus. Surgically, anatomic restoration of the perineal body during posterior repair reestablishes the perineal muscles and levator ani thereby correcting the defect.

The superficial transverse perinei are narrow strips of muscle that originate from the ischial tuberosity on each side and insert on the perineal body (central tendon). The ischiocavernosus muscle arises from the ischial tuberosity and the clitoral crura along the inferior portion of the ischiopubic ramus and insert on to the body of the clitoris. The bulbocavernosus muscle runs on either side of the vagina and attaches to the perineal body posteriorly and the body of the clitoris anteriorly. The blood supply is through the branches of the internal and external pudendal vessels and innervation is via the perineal branch of the pudendal nerve from below and direct branches from the sacral plexus and the pelvic splanchnic nerves from above.

Perineal Body

Also called the central perineal tendon is a poorly defined aggregation of fibromuscular tissue located in the midline between the posterior fourchette and the anus and believed to be an insertion point for the following perineal structures: bulbospongiosus, external anal sphincter, vaginal muscularis, superficial transverse perineal muscle, perineal membrane, and pubovisceral part of the levator ani. DeLancey et al in 2008 demonstrated the relationship of the superficial and deep muscles to the perineal body in their MRI study of 20 nulliparous women.³¹ Shafik et al in their cadaveric study of 56 cadaveric specimens found the perineal body to be an area where perineal muscles cross from one side to another without insertion at a particular site.³²

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