

# ANATOMY

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The reproductive structures of the dividing embryo differentiate after the seventh week of development. The gonads and internal and external genitalia constitute the sex organs. In the female, the Müllerian ducts develop into the uterus, fallopian tubes, cervix and upper third of the vagina. The urogenital sinus in turn forms the lower two-thirds of the vagina. The female external genitalia are described as the vulva, which is bordered by the mons pubis anteriorly and the labio crural folds posterolaterally. The opposing skin that covers the introitus is known as the labia majora. The labia minora are folds of skin that fuse anteriorly around the clitoris, which contains erectile tissue similar to the penis in the male. The posterior part of the introitus is referred to as the fourchette and this stretches considerably during childbirth to allow delivery of the baby. The vagina is an elastic, distensible tube, approximately 6–7 cm long, passing upwards and backwards from the introitus. The cervix protrudes into the vault of the vagina, dividing it into the anterior, posterior and lateral fornices. Pelvic structures can be felt in the posterior and lateral fornices on bimanual examination, as the vaginal vault sits just below the pouch of Douglas (the area at the bottom of the pelvic cavity bordered by the uterus anteriorly and rectum posteriorly). The urethra and bladder neck sit above the anterior wall of the vagina; the perineal body and rectum behind the posterior wall (Figure 87.1). The uterus consists of a body and a cervix (neck of the uterus) and is an upside-down pear-shaped structure that is flattened anteroposteriorly, giving its cavity a flat, triangular shape. The uterus is supported partly by ligaments attached to Johannes Peter Müller, 1801–1858, Professor of Anatomy and Physiology, Berlin, Germany, described the paramesonephric duct in 1825. James Douglas, 1675–1742, anatomist, midwife and physician to Queen Caroline, London, UK, helped expose the fraudulent claims of Mary Toft, who, in 1726, famously tricked a number of doctors into believing that she had given birth to rabbits. Gabriele Falloppio (Fallopius), 1523–1563, Professor of Anatomy, Surgery and Botany, Padua, Italy. He carried out what may have been the first clinical trial in over 1000 men of the use of condoms to prevent transmission of syphilis. - - - - - the cervix (transverse cervical, pubocervical and uterosacral) that consist of condensed connective tissue. The cervix is a canal, approximately 2–3 cm long in the non-pregnant woman, connecting the external os, which can be seen on speculum examination, to the internal os, where the cervix enters the uterine cavity. The uterine cavity to cervical length ratio varies through hormonal influences and developmental phases, with the uterine body increasing in size as puberty progresses. The cervical canal is located within the centre of the bony cavity of the pelvis, with the uterus pivoted around this point. It is more commonly angled forwards (anteverted) relative to the vagina. It is usually freely mobile, with filling of the bladder

Causes of abnormal uterine bleeding in the non-pregnant • state Surgical management of endometriosis, adenomyosis, • uterine fibroids, uterovaginal prolapse and ovarian tumours Pouch of Ovary Cervix Douglas Rectum Uterus Bladder Urethra Introitus Anus Figure 87.1 Female anatomy.

or changes in position rotating it backwards. In others, it can be retroverted, a variation of normal, or secondary to weak ligaments or because it becomes adherent as the result of a disease process such as endometriosis. The uterus may also be angled forwards (anteflexed) relative to the cervix or backwards (retroflexed), which can be determined through bimanual examination. The uterine walls are 1–2 cm thick and composed of smooth muscular tissue (myometrium). The uterine cavity is lined with endometrium, a tissue that undergoes cyclical changes in response to ovarian hormones. The endometrium has both a basal and functional layer. The basal layer lies adjacent to the myometrium and from it develops the functional layer. The basal layer is not shed during menstruation, unlike the functional layer. The functional layer is influenced by oestrogen and progesterone, which thicken it, preparing the lining for implantation. This layer is completely shed during menstruation should conception not occur. In the lean patient, the uterine size can be estimated on palpation. This is usually a subjective assessment outside of imaging modalities. The most common cause of an enlarged uterus, apart from pregnancy, is fibroids (benign tumours of the myometrium) growing inside or outside of the uterus. In the presence of fibroids or other conditions causing enlargement of the uterus, the uterine size is often described in terms of the number of weeks' gestation it approximates to, were the woman pregnant. At the uterine fundus, on either side, are the cornua, which connect the uterus to the fallopian tubes. These are thin, muscular tubes, approximately 10 cm long. They are divided into four parts: intramural, isthmus, ampulla and the fimbriated opening, which picks up the oocyte following its release at the time of ovulation. The tubes are very narrow in the isthmic and intramural parts but widen at the ampullary region. Each tube is contained within the upper part of the broad ligament, a fold of peritoneum on either side of the uterus, which also contains blood vessels as well as the round and ovarian ligaments. The fimbriated opening and part of the ampulla, however, are free and closely associated with the ovary on either side. The ovaries are flattened, ovoid structures, approximately 3–4 cm in dimension, suspended from the back of the broad ligament on either side of the pelvic side wall by the ovarian ligament, which originates from the uterine body. The ovarian blood vessels are contained within the infundibulopelvic ligaments, which are continuations of the broad ligament to the pelvic brim on either side. A sound understanding of pelvic anatomy is key to surgical excellence and safety (Figure 87.2). The sacral promontory is considered a crucial landmark and the summit of the pelvis. While pelvic pathology may reach into the abdominal cavity, the origin is always below the sacral promontory. The sacrum is a bony prominence that is used as a point of reference in surgery and in surgical anatomy. The sacral promontory is the level at which the common iliac vessels bifurcate into the external and internal iliac vessels, and the level at which the ureter transverses from the lateral to medial side. Another key structure at this level is the superior hypogastric nerve plexus (autonomic nerve plexus), which is

Space of Retzius Median Bladder paravesical space Vesicovaginal space Uterine artery Vagina  
 pararectal Rectovaginal septum/space Medial pararectal space/ Bladder Okabayashi space  
 Retrorectal space Sacrum Figure 87.2 Surgical anatomy of the pelvis, including the key surgical  
 spaces, vessels and nerves in relation to the pelvic organs (illustrative representation of anatomical  
 spaces by PR Supramaniam). External iliac vein External iliac artery Lateral paravesical space  
 Iliolumbar Obturator trunk nerve Psoas muscle Lateral space/ Obturator Latzko fossa space Ureter  
 Genitofemoral nerve

nerves. The aorta bifurcates at the level of the L4 vertebral body, where it forms the right and left common iliac vessels. The common iliac vessel then further bifurcates as described above at the level of the sacral promontory. The external iliac artery mainly supplies the lower limbs and has

one anterior branch known as the inferior epigastric artery . Note should be made of the position of this artery when determining placement of lateral ports during laparoscopy , to avoid vascular injury . The internal iliac artery divides further into the anterior and posterior divisions. The anterior division is the main blood supply to the vital organs of the pelvis. The posterior division mainly supplies the gluteal region. The anterior division travels parallel to the ureter and gives off its first branch, the uterine artery , followed by the superior vesical artery , and continues as the obliterated umbilical artery . There is often a 5- to 6-cm distance from the origin of the anterior division prior to the first branch. This is often the level at which surgeons perform internal iliac artery ligation to manage cases of massive haemorrhage during obstetric surgery and prophylactically in pelvic exenteration surgery . The pelvic structures are supplied by the autonomic nervous system. The inferior hypogastric nerve (T10–L2) provides sympathetic fibres and the pelvic splanchnic nerve provides parasympathetic fibres. These fibres merge to supply both the ureter and urinary bladder and can often be injured in complex pelvic surgery , leading to complications of residual bladder dysfunction and sexual dysfunction. Pelvic spaces have recently featured in surgical anatomy as a key learning point to aid surgeons in performing safe surgery . The retroperitoneal spaces are divided into those that are present bilaterally (pararectal and paravesical spaces) and those that are present in the midline (space of Retzius, rectovaginal space and the retrorectal space). The pararectal space is bound medially by the rectum and laterally by the internal iliac artery . The posterior leaf of the broad ligament forms the roof and the levator ani muscle forms the floor. Cranially , the space is bordered by the uterine artery . The pararectal space is further divided into medial and lateral spaces by the ureter, with the medial pararectal space also known as the Okabayashi space and the lateral pararectal space called the Latzko space. The paravesical space is a retroperitoneal space that is lateral to the urinary bladder. Medially it is bound by the urinary bladder, laterally by the pelvic walls and inferiorly by the uterine artery . The paravesical space is further divided into medial and lateral spaces by the obliterated hypogastric artery . The floor of the medial paravesical space is formed by the levator ani muscle. The obturator and pelvic lymph nodes are contained in the lateral paravesical space, important during a radical hysterectomy , and the limit of dissection is bounded by the posterior limit of the obturator nerve. The space of Retzius is the midline retroperitoneal space between the bladder and the anterior abdominal wall. It is Anders Retzius , 1796–1860, Swedish anatomist. Hidekazu Okabayashi , 1884–1953, Japanese gynaecologist, demonstrated the first nerve-sparing radical hysterectomy in Kyoto Imperial University Hospital, Kyoto, Japan, 1921. Wilhelm Latzko , 1863–1945, Austrian gynaecologist, described a technique for vaginal closure of vesicovaginal fistula following a hysterectomy , 1914. Heinrich Wilhelm Gottfried Waldeyer-Hartz , 1836–1921, Professor of Pathological Anatomy , Berlin, Germany . the obliterated hypogastric artery . This space is often used in urogynaecological procedures as the bladder neck is exposed, aiding surgery performed for incontinence. It is also used in deep endometriosis surgery during management of bladder nodules to aid in tension-free closure of the cystotomy . The rectovaginal space refers to the posterior retroperitoneal space that is formed by the uterus anteriorly and the rectum posteriorly . The lateral borders of this space are provided by the uterosacral ligament. This space is often explored to aid in radical hysterectomy and deep endometriosis surgery . The retrorectal space is a retroperitoneal space that is bound by the rectum anteriorly . It is often explored in complex pelvic surgery and deep endometriosis surgery associated with excision of the rectum. The presacral vein that lies posterior to Waldeyer's fascia is often an area of concern because, if not carefully dissected, it can lead to severe uncontrollable haemorrhage.

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