

# **Anatomy of the Equine Female Reproductive System**

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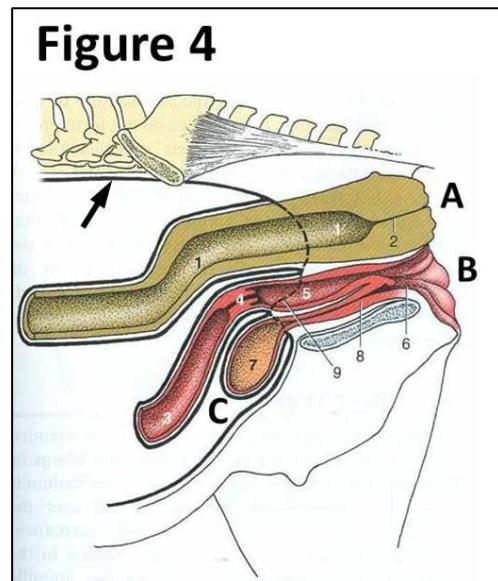
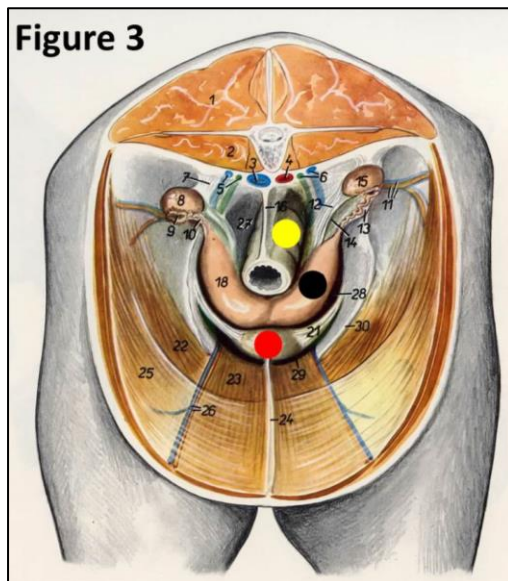
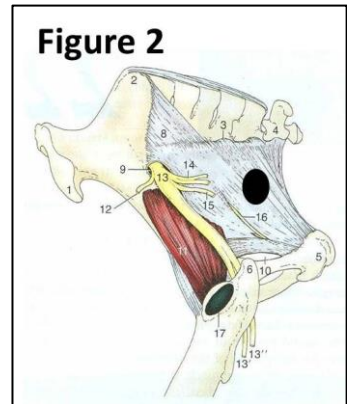
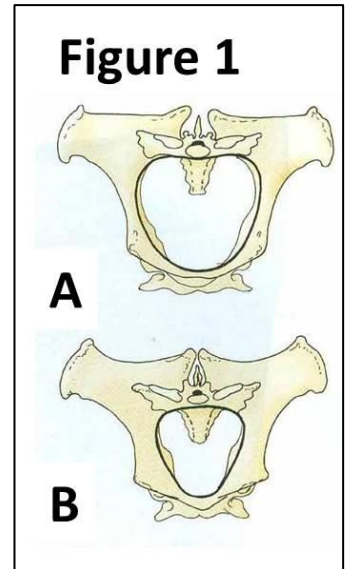
## Introduction

The study of the anatomy of the reproductive systems, both male and female, is important for at least three main reasons: First, they should be evaluated for **breeding soundness**. Second, they can be utilized for **rectal palpation**. Third, the reproductive systems can be affected by **various diseases**. The following lecture will describe the female reproductive system.

The female reproductive system is located in part in the pelvic cavity (Figure 1). This cavity is roofed by the sacrum and first two or three caudal vertebra (Figure 2) and is narrowed caudally. The lateral wall of the pelvic cavity is protected by the **sacrosciatic ligament** (black circle, Figure 2), and the floor is relatively horizontal / flat and formed by the fusion of the pelvic symphysis (Figure 1, A and B). The pelvic inlet of the female is rounded and wide (Figure 1, A) while the male is angular and cramped (Figure 1, B). Finally, the outlet is much smaller than the inlet.

The pelvic cavity (Figure 3) contains three structures:

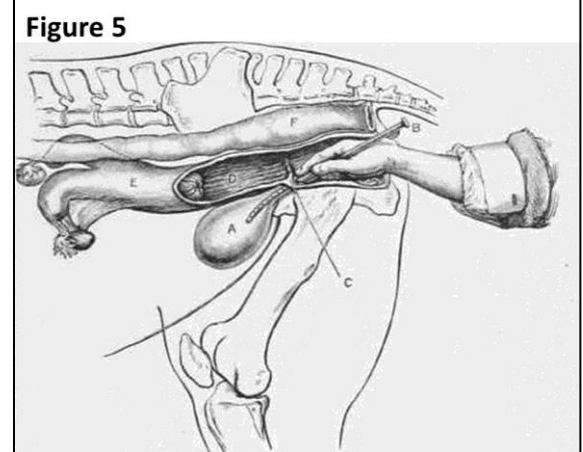
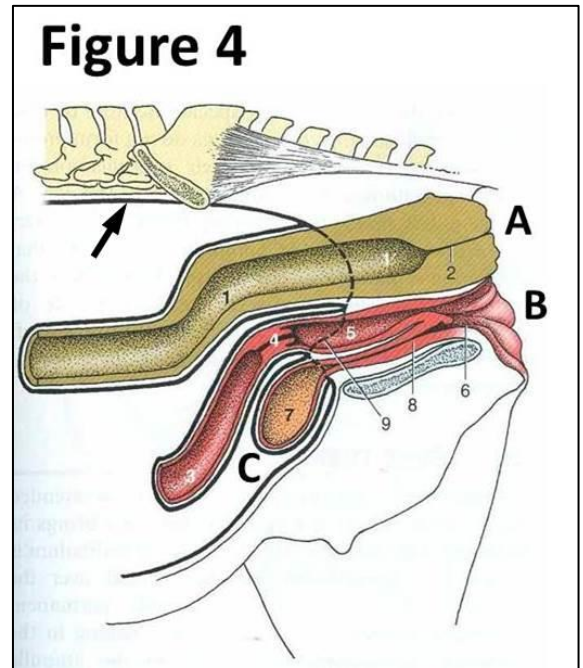
1. Rectum and anal canal (Figure 3, yellow circle),
2. Bladder and urethra (Figure 3, red circle), and
3. Reproductive organs (Figure 3, black circle).



The **rectum** is the terminal part of the gastrointestinal tract (Figure 4, A) which ends with the **ampulla**, the place of fecal storage before evacuation, and then as the **anal canal**, where there are no feces. The rectum is completely **retroperitoneal** (Figure 4, arrow points at the peritoneum). In mares the rectum is located dorsal to the uterus and vagina (B, Figure 4) whereas in males the rectum is dorsal to the bladder, urethra and accessory reproductive glands.

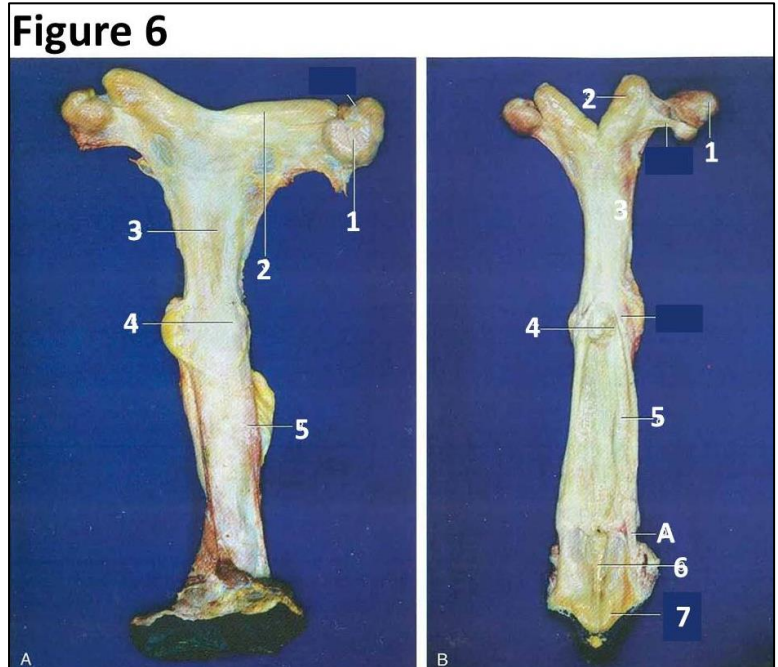
The **bladder** and the **urethra** are parts of the urinary system (C, Figure 4). The dorsal surface of the bladder is in contact with the vagina, cervix, and uterus (sometimes rectum). The urethra (short, 6 cm) opens into the **vestibule**, caudal to **the transverse fold of the hymen**, which makes it accessible for urethroscopy or catheterization (Figure 5).

The bladder, similar to the rectum, is **retroperitoneal** (Figure 4). In mares, the **neck of the bladder** resides on the floor of the pelvic, and when the bladder fills it moves cranially (slides, moves forward) to the abdominal cavity. In neonates, the bladder resides in the abdominal cavity. As such, **patent urachus** or **urine leaking** from the umbilicus is a common clinical case in equine neonatology that requires surgical correction to prevent infection, uremia, and toxemia.



The equine female reproductive organs (Figure 6A and B) consist of the following:

1. Two ovaries (Figure 6, 1)
2. Uterine tubes (Figure 6, 2)
3. Uterine body (Figure 6, 3)
4. Cervix (Figure 6, 4)
5. Vagina (Figure 6, 5)
6. Vestibule (Figure 6, 6)
7. Vulva (Figure 6, 7)

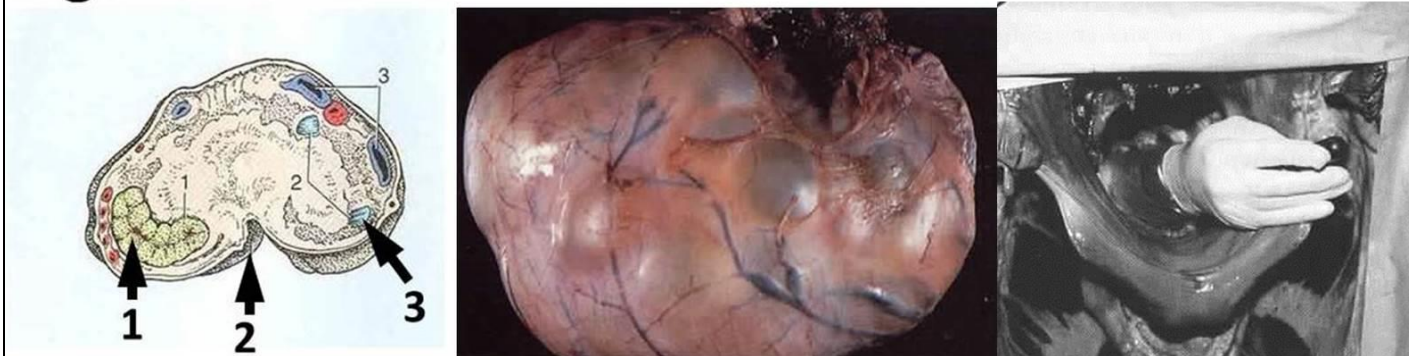




## Ovaries

The **ovaries** of the mare are **kidney bean shape** (Figure 7). The ovaries are located on both sides of the dorsal abdomen ventral to the 4<sup>th</sup> or 5<sup>th</sup> lumbar vertebra, caudal to the kidneys, and cranioventral to the iliac wings and suspended with mesovarium.

### Figure 7



Each ovary is 6 to 10 cm in length and 3 to 4 cm in height depending on the size of the horse and the stage of estrous. The ovary of the mare consists of a medial and a lateral surface and each ovary contains a cranial and a caudal pole. The ovaries are attached dorsally and free ventrally. The ventral border contains a depression known as the **ovulation fossa** (Figure 7, 2). Finally, the ovaries are covered by the peritoneum except on their dorsal aspect where the nerves and vessels enter.

The ovary of the mare consists of a **medulla**, which is vascular and is located superficially, as well as a **cortex** which is located deep in the tissue and contains the follicles (Figure 7, 3). The follicles reach the surface of the ovary at the ovulation fossa when it is time for ovulation and the development of a **corpus luteum** (Figure 7, 1). Functionally, the ovaries produce gametes and hormones.

The ovaries can be examined by two methods: rectal palpation and ultrasound (Figure 7). **Ovariectomy** or removal of the ovaries in mares can be done through a flank incision (make sure to suture the abdominal tunic) or a trans-vaginal incision (an incision through the vagina, Figure 10). This is a good approach because the ovaries are retroperitoneum.

### Figure 10



## Uterine Tubes

The **oviduct** of the mare is 20 to 30 cm in length and consists of three parts:

1. Infundibulum
2. Ampulla
3. Isthmus

Functionally, the oviduct transports the oocyte from the ovary to the uterine body and acts as a site of fertilization.

The **infundibulum** is funnel-shaped structure which resides in close proximity to the ovary. It attaches to the lateral surface of the ovary at the ovulation fossa and uses finger-like projection called **fimbriae** to move the oocyte from the ovary to the oviduct.

Once in the oviduct, the ovum passes into the **ampulla** where fertilization takes place. The fertilized ovum then moves to the **isthmus**, the narrowest portion of the oviduct. This structure is highly muscular and it helps to transport the embryo to the uterus. During estrous, the isthmus contracts to propel the sperm toward the ampulla and the ovum.

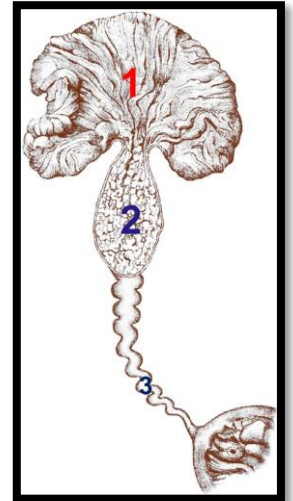
At the end of the oviduct there are **oviductal papilla**. In the center of the papilla lies the **uterotubal junction** which contains deep longitudinal folds. This area helps in the selection of sperms by making it difficult for poor swimming sperms to pass through the junction.

## Uterus

The **uterus** (Figure 6) consists of one large body and two horns suspended (floated with the intestinal viscera) in the pelvic cavity by the **broad ligament** dorsally. The portion of the broad ligament that is closest to the uterus is called the **mesometrium**. The uterine wall consists of three layers: serosa, myometrium (muscles) and endometrium. The **serosal** layer and the vessels of the uterus are continuous with the broad ligament. The **myometrium** consists of two muscle layers — inner circular and outer longitudinal — that contract during estrous and parturition. In addition, during estrous, the myometrium varies, changing in tone during rectal palpation. The **endometrium** is glandular and has a secretory function.

The blood supply of the uterus consists of three arteries and veins:

1. Uterine artery and vein
2. Uterine branch of the vaginal artery and vein
3. Uterine branch of the ovarian artery and vein

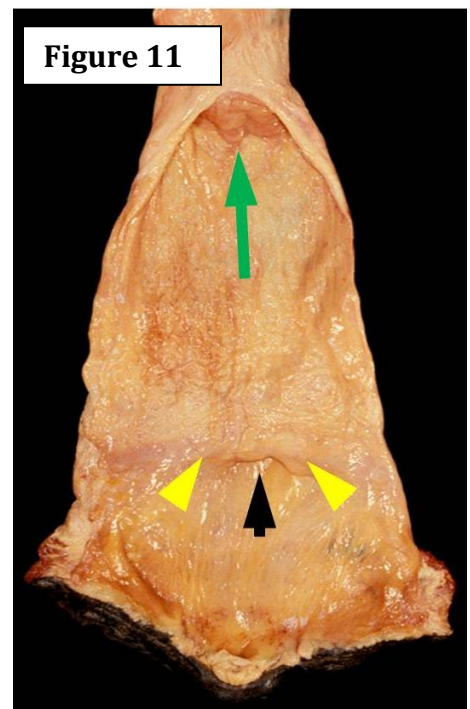


## Cervix

The **cervix** of a mare is short, approximately 5 to 7.5 cm in length and 2 to 4 cm in diameter (Figure 11, green arrow). Unlike cattle that have transverse cervical rings present in the cervix, horses only have longitudinal folds that are continuous with the endometrial folds of the body of the uterus. Thick muscular layers make the cervix easy to palpate (firm during rectal palpation) and the presence of elastic fibers allow the contraction and expansion of the cervix. The external **os of the cervix** protrudes into the vaginal lumen and is surrounded by the **vaginal fornix** (Figure 11, black arrow), arrow. Functionally, the cervix:

1. Provides lubrication during estrous
2. Acts as a barrier for the uterus during pregnancy
3. Produces mucus, which varies in viscosity and function depending on the stage of estrus / pregnancy

During pregnancy, the mucous forms a plug that helps to occlude the cervix and makes it less permeable to bacteria and foreign objects. However, during estrous, the cervix becomes flaccid and the external os of the cervix lies on the floor of the vagina. When a stallion is breeding the mare, the cervix is able to expand and accommodate the penis. In a typical breeding examination and rectal palpation, the cervix is often palpated and can be visually examined.



## Vagina

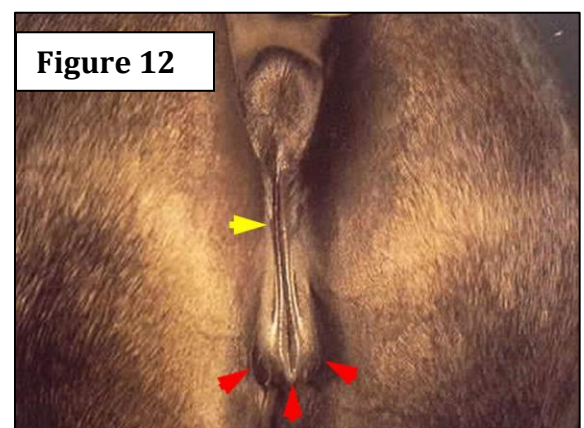
The **vagina** (Figure 11, space between green and yellow and black arrows), often called the “**vaginal vault**”, is a tubular structure 15 to 20 cm long. It resides dorsal to the bladder and urethra and ventral to the rectum. The cranial portion of the vagina lies within the peritoneal cavity and is covered with serosa while the posterior portion, the larger part, is in a retroperitoneal position. Due to most of the vagina being in the retroperitoneal position, vaginal injuries do not perforate into the peritoneal space. Therefore, ovariectomy (Figure 10) can be done trans-vaginally (though the dorsal surface of the vagina). The lumen of the vagina is covered with stratified squamous epithelium; therefore, it has no glandular structures.

## Vestibule

The **vestibule** is the space located from the urethral orifice, covered with the transverse fold to the vulva. It is glandular and secretes mucous to provide lubrication to the remaining portion of the female genital tract.

## Vulva

The **vulva** is the external opening to the mare's reproductive tract which is 12 to 15 cm long and located as a **rounded ventral commissure** (Figure 12, red arrows) and a **dorsal pointed commissure** (Figure 12, yellow arrow).



## Udder

The **udder** in equine is located between the thighs and consists of two halves (Figure 13). Each half contains one teat and each one contains 2-3 openings. The two glands – halves – interdigitates and therefore it is hard to separate them. The two halves are attached to the abdominal wall by a **suspensory ligament** and they are supplied by the external pudendal artery and vein.

