Foreign bodies of habitual use found in the vaginal cavity in the x-ray, CT scan and MRI

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Learning objectives

- To make a review of the vaginal anatomy and foreign objects of common use that can be found in the vaginal cavity.

- To describe the location, morphology and density/intensity typical of foreign bodies and material of common use that can be found in the vaginal cavity in simple radiology, computed tomography and magnetic resonance imaging to avoid confusion with other entities.
Background

The vaginal cavity is a tubular elastic and fibromuscular structure which forms part of the internal female genital tract. We can find lots of foreign bodies lodged inside, especially in younger patients. However, there are multiple foreign bodies and material commonly used such as vaginal tampons, gels, pessaries or vaginal rings among others, which may mimic pathology in studies of simple radiology, computed tomography or magnetic resonance imaging, if their morphology, location and density/intensity typical are unknown.
1. ANATOMY OF THE VAGINA

The vagina is a tube that connects the uterus to the vulva. Normal and pathological secretions of the uterus come through it, as does the fetus and it is annexed during childbirth. It has a tubular longitudinal morphology with an oval caliber because the anteroposterior axis is less than the transversal axis, except in its upper portion which surrounds the uterine cervix with portio morphology. It is usually oriented upper and dorsal. It has approximately 7-8 cm in length.

The inner surface is rough, for the presence of longitudinal and transverse folds formed by clusters of elastic tissue that allows a great distensibility. The longitudinal folds form the rough anterior and posterior columns; the transversal are born of these main folds and extend towards the edges. The previous rough column ends in its upper portion, forking it and constituting two sides of an equilateral triangle, whose base is a transverse retraction of the mucosa, located almost 2.5-3 cm below the outer hole in the neck. This triangle, called the Pawlick, has clinical and surgical value because it is vaginal vesical trigone of Lieteaud projection.

- The anterior face of the vagina is related in caudal and cranial direction with the urethra and bladder (Figure 1).

- The posterior face is related to peritoneal, perineal and rectal areas (Figure 1). The posterior wall is longer than the anterior wall and its width is approximately 2.5 - 3 cm.

- The top margin of the vagina is inserted in the lower third of the neck (Figure 1). There are four parts call vaginal fornix: anterior, posterior and laterals. Posterior fornix is the deepest and corresponds to the middle segment of a thin layer of cellular tissue and the posterior face with the pouch of Douglas and rectum. The side edges are in relation with the terine artery, venous plexus and the distal third of the ureter. The lower portion of the cervix located below the visible vaginal insertion with the placement of a speculum, is called portio. Intravaginal neck segment has cone shape and is directed to posterior vaginal fornix, its vertex present the outer hole of the neck and consists of 3 layers: the outermost (exocervix), consisting of multilayered stratified epithelium equal to the vagina epithelium, except which has smooth surface and little papillae, an average with muscle and connective tissue which is almost all the thickness of the neck, and a mucous inner, consisting of epithelium and glands muciparas.

2. IMAGING FINDINGS
The vagina can be evaluated with ultrasound, CT or MRI. However, when there is a suspicion of gynecological pathology vagina can be undervalued in routine ultrasound due to its position or in the TAC by the poor tissue characterization. The RM allows an excellent characterization of the tissues of the vaginal area. Its study requires anatomical and embryological knowledge for understanding the development and congenital pathology. In addition, it is important to understand the limitations of each study of image for the valuation of the vagina.

**Ultrasound:**

The transabdominal study in sagittal plane the vagina is identified as a tubular hipoecogenic structure collapsed with central linear image hiperecogenic which corresponds to the mucosa. The vagina is more difficult to identify when the vaginal mucosa is less hiperecogenic due to the lack of estrogens in postmenopausal. The transabdominal gynecological ultrasound may be useful in the assessment of congenital anomalies in patients of younger ages (Figure 2).

**CT:**

If you suspect vaginal pathology the placement of a vaginal tampon or the introduction of ultrasound gel in vagina helps us to better define the vagina and its relation to adjacent structures. However, in the majority of occasions CT studies are performed in women with nonspecific abdominal pain so you have not received this preparation, so we should know the normal anatomy of the vagina without the help of a tampon or intravaginal gel. In the fertile patients the vaginal mucosa enhances intensely by the hormonal influence while the vagina wall is relatively hypodense and hardly delimited with regard to adjacent structures (Figure 3). In postmenopausal patients, vaginal mucosa is hypodense and therefore similar to the vaginal wall and adjacent structures, which hinders their assessment (Figure 4).

**MRI:**

The wall of the vagina is better valued in sequences T2 (figures 5 and 6). The vagina has a uniform and intermediate intensity of signal in T1 sequences which make its valuation difficult, so it is only useful for tissue characterization and the study of enhancement after administration of civ. Administration of intravaginal gel allows a better assessment of the vagina and delimitation of adjacent structures (figures 5 and 6). The appearance of the vagina varies with the phase of the menstrual cycle so that the wall and the central mucosa are thickened and high-intensity signal on T2 during half of the secretory phase while the greatest contrast between the vaginal wall and the adjacent pelvic fat occurs during late secretory phase or the early proliferative phase. In postmenopausal women receiving hormone therapy the image from vagina is similar to the premenopausal
women. In postmenopausal women without hormone therapy the wall of the vagina is hypointense on T2 and mucosa thickness is lower.

3. EXTERNAL MATERIAL COMMONLY USED IN VAGINA:

Ultrasound gel:

The use of ultrasound gel in CT and MR improved the valuation of vaginal anatomy to defuse the folds of its walls (figures 5, 6 and 7). The introduction of gel in the vaginal cavity allows a correct valuation of their morphology to rule out anatomical variants as the presence of internal partitions (Figure 8), defines better cervix tumors and facilitates the assessment as morphological alterations as uterine pathology (Figure 9) and other adjacent structures. Tomographic study of vaginal cavity after the introduction of gel is shown in relaxed with liquid density content inside. The RM the vaginal cavity is distended and occupied by fluid signal intensity material: hypointense on T1 (Figure 7) and hiperintense in T2 (Figure 5 and 6).

Vaginal tampon:

It is usual to see vaginal tampons in young women and in middle- age women who have had radiological study during menstruation. However, tampon also can be useful in imaging studies to evaluate the anatomy of the vagina and surrounding structures. The tampon in a way similar to gel distends, although less, the walls of vagina facilitating interpretation of the image, the localization of lesions and the valuation of anatomical variants. Tampons usually unnoticed in the simple radiography, a tenuous tubular image of low-density (next to air) can be appreciated in hypogastrium drawing vaginal cavity. The tomographic study shows an occupation of the vaginal cavity by material of air density with tubular morphology. The tampon is identified in MR as an occupation of the vaginal cavity by tubular material of low-intensity signal on T1 and T2 (Figure 10). The T1 sequence allows a better definition anatomical with more clear edges of the vaginal walls (Figure 10).

Pessary:

It's a round object that is hosted in the vagina for extended periods of time to avoid vaginal, rectal, uterine prolapse or prevent urinary incontinence. They are designed to defuse the walls of the vagina. They usually stay in the posterior portion of the vagina close to the cervix. Although it is a safe and effective method they have been replaced by surgical treatments. However, it is not unusual to find elderly patients with pessaries. There are pessaries of different materials and sizes that vary its presentation. The most used is the pessary with the form of ring or "donut" of silicone (Figure 11). In the simple radiography it usually presents as a rounded structure, with "donut" shaped with soft tissue density and a thin halo of air density on its inner margin (figures 12 and 13). In the TAC we can
confirm its location inside of vagina, "donut" shaped and high density (Figure 14 and 15). In the axial plane depending on the level of cutting we will identify a hyperdense tubular structure in the vaginal cavity if the cutting is done through one end of the pessary (cranial or caudal) or two rounded hiperdense images in vaginal cavity anterolateral to the rectum (Figure 14 and 15) that they will progressively approaching if we move the cutting level.

**Vaginal ring:**

The vaginal ring is a hormonal contraceptive that sits in the vaginal cavity. In Imaging tests it is similar to a pessary, but smaller in size and thickness, and unlike the pessary is often found in young patients. In the simple radiography it can go unnoticed or identify a hyperdense annular structure in hypogastrium. In the tomographic study it is as an object with the form of ring, hipodense, housed inside of the vaginal cavity (Figure 16). Like the pessary, by its annular morphology, depending on the level of cutting it will be able to identify in the axial plane as a transverse tubular structure (cranial or caudal ends of the ring) or two rounded images into vagina, at the same height, which will progressively approach to join if we move images. However, unlike the pessary they also have a smaller calibre and they are hypodense with a density close to that of the air (Figure 16).

In summary (Figure 17):
Fig. 1: Sagittal T2 image. Vaginal Cavity (VA) relaxed by the introduction of intravaginal ultrasound gel is displayed hyperintense on T2 and facilitates the assessment of the vaginal wall and the rest of the adjacent structures. The front face of the vagina limits in craniocaudal direction with the uterine body (U), the bladder (V) and the urethra (U). The rear face limited to the rectum (R). The vaginal dome is delimited by the uterine cervix (C).

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**Fig. 2:** Gynecological Ultrasound Study pre-pubescent boy in a girl that came in the emergency room for pain in hypogastrium. Presents marked distention of the vaginal cavity by homogeneous material and mobile with vaginal walls smooth in relation to hematocolpos secondary to imperforate hymen. In the image lower right there are two uterine cavities by the presence of bicornuate uterus.

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**Fig. 3:** Axial tomographic image at the level of the vagina in a premenopausal patient. The mucus in the vagina is a linear image with enhancement (arrow) by the estrogenic stimulation, collapsed and surrounded by the hypodense vaginal wall.

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Fig. 4: Sagittal scan image at the level of the vagina in postmenopausal patient. The wall of the vagina is hypodense as in the fertile patients. However, unlike these, the vaginal mucosa does not enhance by the absence of estrogenic stimulation, so that is indistinguishable from the vaginal wall.

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**Fig. 5:** Axial T2 image. Vaginal cavity relaxed by the introduction of intravaginal ultrasound gel is displayed hyperintense on T2 and facilitates the assessment of the vaginal wall and the rest of the adjacent structures. The front face of the vagina limits in this court with the bladder and the back side with the pouch of Douglas, and the rectum.

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Fig. 6: Sagittal T2 image. Vaginal cavity relaxed by the introduction of intravaginal ultrasound gel is displayed hyperintense on T2 and facilitates the assessment of the vaginal wall and the rest of the adjacent structures.

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**Fig. 7:** Axial T1 image. Vaginal cavity relaxed by the introduction of intravaginal gel shown hypointense in T1.

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**Fig. 8:** Pelvic MRI with intravaginal administration of gel shown hypointense in T1 and hyperintense in T2. The gel relaxes the walls of the vagina by facilitating their morphologic assessment. There is a septum left anterolateral fine that crosses the vaginal cavity (arrows). Without the distention of the vagina by the gel this finding would have gone unnoticed.

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Fig. 9: Pelvic MRI with intravaginal administration of gel hyperintense on T2 that distends the vaginal cavity and facilitates the assessment of the adjacent structures. Previous to the vaginal cavity are identified two uterine cavities in relation with uterus didelphys.

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**Fig. 10:** Sagittal Image pelvic in T1 and T2 with a vaginal tampon. It identifies a tubular structure in the interior of the vaginal cavity of tubular morphology hypointense in both T1 and T2. The vaginal walls and the contour of the buffer are better defined in the T1 sequence.

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**Fig. 11:** 3D tomographic reconstruction of pelvic region in patient carrier of pessary. Pessaries are of different shapes, sizes and materials. The most commonly used are the o-rings and silicone as referred to in the image.

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**Fig. 12:** Simple abdominal radiography in patient older woman. As an incidental finding ring structure is displayed in the form of "donut" projected in hypogastrium, with soft-tissue density and fine inner halo density of air, in relation to pessary (arrows). Double J catheter in track excretory right.

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**Fig. 13:** Simple abdominal radiography in patient older woman. As an incidental finding ring structure is displayed in the form of "donut" projected in hypogastrium, with soft-tissue density and fine inner halo density of air, in relation to pessary (arrows). Calcification projected in the right hypochondrium.

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**Fig. 14:** Pelvic CT with intravenous contrast in elderly patient. It identifies occupation of the vaginal cavity by foreign body annular morphology or "donut" hyperdense, in relation to pessary (arrows). In the image the more superior court has been carried out in the caudal end of the pessary and in the bottom half of the pessary where is shown as two images rounded hyperdense anterolateral vaginal to the rectum.

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**Fig. 15:** Pelvic CT with intravenous contrast in elderly patient. It identifies occupation of the vaginal cavity by foreign body annular morphology or "donut" hyperdense, in relation to pessary (arrows). In the cuts made in the middle of the pessary is shown as two images rounded in the vaginal cavity that in as cranial and caudal are approaching. The pessary was an incidental finding in a patient with politraumatizada subcutaneous and pelvic emphysema.

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**Fig. 16:** Pelvis CT with intravenous contrast in a young woman. As an incidental finding is identified occupation of the vaginal cavity by a object of strange annular morphology similar to a pessary but of a smaller size and density similar to air, in relation to vaginal ring (arrows).

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Fig. 17

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Fig. 18: Axial image of pelvic CT with intravenous contrast and axial MIP reconstruction in middle-aged woman. Hyperdense image in the form of "T" on the inside of the uterine cavity in relation with IUD.

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Fig. 19: Coronal image of TAC with intravenous contrast in middle-aged woman. Presents occupation of the uterine cavity by material in hyperdense linear relationship with IUD (upper portion).

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Fig. 21: The first image corresponds to a simple X-ray pelvis in a patient with two foreign bodies of small tubular density gauge metal in hypogastrium projected in relation with ESSURE. In the second image of hysterosalpingography checked its correct location in the fallopian tubes with absence of passage of contrast to the peritoneal cavity.

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**Fig. 20:** Sagittal Image of TAC with vic and oral in middle-aged woman. Presents occupation of the uterine cavity by material in hyperdense linear relationship with IUD (lower portion).

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Fig. 22: Images of hysterosalpingography in patient with ineffective ESSURE by presence of contrast to the peritoneal cavity (arrows) through the eustachian tube right.

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Conclusion

There are multiple foreign objects of habitual use which can be found in the vaginal cavity in simple radiology, computed tomography and magnetic resonance studies. The knowledge of them avoids misinterpretation of images and confusion with adjacent pathology. The use of intravaginal ultrasound gel or vaginal tampons facilitates the assessment of morphology and vaginal pathology and adjacent structures.
References
