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Indications for Endoscopic Examination of the Mare

Endoscopic examination of the mare’s uterus is used as a diagnostic aid for unusual conditions, such as intractable infections, tumors, abscesses, foreign bodies, adhesions, and congenital abnormalities. Endoscopy is also used as an adjunct to a breeding soundness examination or is used as a clinical tool for assisted reproductive procedures such as hysteroscopic insemination.

Anatomic features viewed using endoscopy

The anatomic structures of the mare that may be viewed using endoscopy include: the vagina, vestibulovaginal fold, hymen in maiden mares, cervix, uterine body, bifurcation, horn, uterotubal papilla and ostium. Structures that may also be present include endometrial cysts, and endometrial lymphatic cysts. Endoscopy is used to identify and remove foreign bodies, determine the health of the endometrium, evaluate the nature and condition of tumors or hematomas, explore anomalies such as adhesions, and identify congenital abnormalities.

Hysteroscopy - Hysteroscopic Anatomy

The uterus in the mare is Y shaped with a short body that leads to dependently located uterine horns that rise toward the ovary. There are at least a dozen longitudinal folds of endometrial mucosa that form ridges which run from the body into the uterine horns, these are often seen on an ultrasound examination when the uterus tissue is edematous. The area where the uterus divides into the 2 uterine horns is called the bifurcation. The dimensions of the uterine horns are 15-20 cm long and 4-7.5 cm in wide. The longitudinal folds lead to the end of the uterine horn where the uterotubal papilla is located. The uterotubal papilla is located dorsally and eccentrically at the end of the horn. See Figures 1-3.

How to perform a Hysteroscopic Procedure

To prepare a mare for a hysteroscopic examination empty the rectum of manure, wrap the tail, and cleanse the perineum. Generally mares are sedated using an alpha agonist combined with an opioid such as butorphanol to minimize movement and any discomfort. The mare is positioned in a stocks so that following sedation her airway is unobstructed as her head drops and she is positioned near the back of the stocks. Tractable mares in short procedures may not need to be sedated. Due to the expensive nature of the equipment caution should be taken to keep it safe.

The endoscopic equipment should be gas or chemically sterilized and the disinfectant removed using alcohol and then copious amounts of sterile water or saline. Generally 2 people are required to perform a hysteroscopic examination. An examiner wearing a rectal sleeve and sterile surgical glove, passes the equipment through the vagina and cervix into different uterine locations, and an operator directs the tip of the endoscope when required. A one meter gastroscope, or videoendoscope is used. The examiner shields the end of the endoscope in their surgically gloved and lubricated hand and carries it forward to the...
The endoscope is lubricated only on the sides but not the front. The cervical canal is gently dilated by the examiner’s finger and the endoscope is passed, keeping the correct orientation so the tip of the endoscope is just introduced into the uterine body. The cervix is then held closed around the endoscope and the uterus is insufflated.

If the equipment is fully functional, complete uterine insufflation should take less than 20 seconds using filtered room air. In the case where air flow through the scope is low an external insufflation source such as nitrous gas, or CO2 gas may be used. Excessive insufflation pressures will be uncomfortable for the mare and result in gas being released through the cervix. The contents of the uterus may be fully visualized using pressures of 17.8 -30 mmHg. It is important to remember the diameter of the scope may occupy about half the lumen of the uterus, therefore gentle movement only when there is good insufflation and visualization is essential. Following the initial insufflation the pressure is maintained using intermittent or low air flow during the hysteroscopic examination.

The uterine body is examined initially and then the endoscope is passed to the bifurcation of the uterine horns. The bifurcation is cranioventral. Note the tissue folds of the septum at the bifurcation, they should fall dependently, if not the scope is likely upside down reversing the left right orientation and the endometrial folds may be followed along the cranioventral curve to atraumatically enter the uterine horns. Minimal manipulation of the tip of the endoscope is used to pass the endoscope into the uterine horns. The examiner, using their hand in the mare’s vagina and another on the endoscope, feeds and directs the endoscope into the uterine horns usually by watching the progression on a videoscreen. Once a uterine horn has been entered the directional turning wheels of the endoscope may be locked and the tip of the scope directed using fine manipulation as needed to obtain proper views, collect samples, etc. Rarely there is a need to turn the endoscope back on itself to see the area of the internal cervical os. This happens inadvertently with inexperienced ex-

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**Figure 1** - Hysteroscopic view of the bifurcation of the uterine horns.

**Figure 2** - Hysteroscopic view of the uterine horn.

**Figure 3** - Close up hysteroscopic view of the uterotubal papilla.
aminers who move the endoscope when they do have a clear view of the lumen. The endoscope is usually passed to the uterotubal opening. Semen may be deposited by passing a catheter loaded with semen through the biopsy port of the endoscope. The catheter is then advanced so it touches the uterotubal opening and the semen is deposited. Some practitioners confirm the location of the endoscope using a rectal examination prior to or after insemination, others hold the uterine horn closed and only insufflate the desired uterine horn.

Under direct visualization samples such as uterine discharge, fluid aspirates, or guided endometrial biopsies may be collected by passing catheters or endoscopic tools through the biopsy port of the endoscope. In the case of an endometrial biopsy the biopsy instrument is passed through the cervix and immediately directed into the desired uterine horn. Following biopsy bleeding is common therefore this is typically performed last so the blood does not interfere with the rest of the examination.

When the procedure is complete and the entire contents of the uterus have been viewed, the air flow is shut off and the biopsy port opened to allow the gas to be released from the uterus while a rectal massage is used to encourage the evacuation of the air, or suction is used to remove the air/gas. Maintenance protocols for disinfection of the equipment following each procedure are important for maintenance, as repairs on the equipment are costly, in addition there is a need to minimize the risk of iatrogenic transfer of infections between mares.

Post partum uterus

The large size of the post partum uterus makes the procedure difficult to perform and insufflation more difficult to achieve until the uterus is well involuted. The uterus of the mare may be injured during foaling and full-thickness lacerations of the dorsal portion of the uterine horn have been reported. A portion of the placenta may also be retained in the uterine horns, particularly the tip of the non-pregnant horn. These mares presented as a depressed post-partum mares. Some advocate the use of hysteroscopy to help confirm the diagnosis in these cases. The post-partum uterus is difficult to insufflate due to its large volume, large cervix, excessive endometrial folds, and a laceration further increase the difficulty in achieving good insufflation.

Appearance of the Endometrium

While performing the procedure the examiner should focus on colour and texture of the uterus, the presence of discharge, foreign matter, endometrial cysts, endometrial lymphatic cysts, masses, and presence of adhesions. The endometrium of the mare is pale pink and in estrus will have a glistening mucus on the surface, endometrial folds will be edematous and it should have a homogenous texture. The diseased endometrium may have ulcers, plaques, discoloured patches, discharge, and lymphstasis evident. The endometrium of subfertile mares has a pronounced reticular pattern that corresponds to lymphstasis and endometrial gland necrosis. Pyometra refers to a persistent condition where the uterus fills with pus, typically in association with a cervical injury such as adhesions, that mechanically interfere with cervical dilation or patency. The endometrium is often diseased, and may be incapable of secreting prostaglandin, resulting in retained luteal tissue and prolonged diestrous periods. Transluminal uterine adhesion may result due to trauma and inflammation following dystocia, hysterotomy, or intrauterine infusion of caustic materials. Transendoscopic electroscopy and LASER has been used to reduce adhesions.

Endometrial Glandular and Lymphatic Cysts

Endometrial glandular cysts are very small structures usually less than 1 mm in diameter, while the endometrial lymphatic cysts may be very large (> 6 cm in diameter). Lymphatic cysts vary in size and may be present as solitary cysts, or clusters. They are sometimes confused with embryos on ultrasound examinations because they may be round. The cysts vary in significance but generally do not interfere with fertility and grow very slowly over
time. Therefore clinically it is important to note the location and size of endometrial cysts in the uterus. Cystic endometrial structures do not develop heart beats unlike embryos, and for this reason legally if there is no previous examination history, a mare should not be diagnosed in foal until an embryo with a heart beat is identified, and terminology such as a structure “compatible with an embryonic vesicle” should be recorded18,19.

**Hysteroscopic Insemination**

Hysteroscopic insemination and deep horn insemination are techniques for low dose insemination. A reduced number and minute insemination volume are used in this technique. The side where the dominant follicle is located is determined. The endoscope is directed up the uterine horn ipsilateral to the dominant follicle. A small catheter is passed through the biopsy channel of the endoscope and advanced so it touches the uterotubal papilla4,20,21. The inseminate is then injected onto the surface of the papilla. This technique has been successful in achieving pregnancies with low numbers of fresh, frozen thawed sperm22.

**Congenital abnormalities**

Congenital conditions are frequently investigated using hysteroscopy include paramesonephric duct remnants (persistent Müllerian) which form a longitudinal septum like division of the vagina, cervical aplasia, double cervix to determine how it communicates with the uterus, uterus unicornis, and uterus bicollis. Ectopic ureters that empty into the vagina have also been reported in the mare.

**Persistent endometrial cups**

Persistent endometrial cups are a rare finding in bred mares that fail to establish normal estrus cycles following pregnancy loss or post foaling. The cup tissue may be visualized using endoscopy, and is associated with high levels of eCG, and follicular luteinization rather than ovulation. Persistent anovulatory follicles may be a feature of these mares.

**Tumours of the Uterus**

Solid masses in the uterus may be tumours, or intramural hematoma formation. Intramural hematomas form as a foaling injury, and slowly resolve over time. The most common uterine tumor is comprise of smooth muscle and is called a leiomyoma9. Leiomyomas are usually first detected using transrectal ultrasound examination. They are slow growing, range in size from 2-5 cm, and may be pedunculated. As the tumour enlarges it may obstruct the uterine lumen, become necrotic on the surface as it outgrows its blood supply, and subsequently interferes with fertility. Uterine adenocarcinomas have also been reported and result in significant tissue damage, and frequently uterine discharge. Tumors are removed surgically9,23,24. A mare must have 70% of her uterus remaining following surgical removal of the tumor for successful pregnancy. Lymphosarcoma and melanoma may also metastasize to the uterus25.

**Foreign Bodies**

Most foreign bodies in the mare’s uterus are from manufacturing defects in swabs, or rough handling of equipment. The broken culture swabs may be retrieved by manually by dilating the cervix and retrieving the missing piece, or by using uterine lavage to flush out the pieces. In cases where this is not successful implements such as endoscopic biopsy tools, or a biopsy forcep may be used to grab or dislodge a foreign body that is embedded or trapped in the endometrium. The foreign body
is then withdrawn as the endoscope is withdrawn from the uterus.

**Fetal Maceration or Mummification**
Occasionally a fetus dies and the mummified or macerated bones are retained in the mare’s uterus. The bones may be adherent to the endometrium and require manipulations such as bringing the mare into heat and using manual cervical dilation or use of tools through the endoscope’s biopsy port to dislodge them.

**REFERENCES**