Review of Hysteroscopy in the Mare: A Video Perspective

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Videoendoscopic examination of the cervix and uterus (hysteroscopy) is a valuable procedure for reproductive tract issues that cannot be detected or resolved by other means. Authors’ addresses: Colorado State University, 3101 Rampart Road, Fort Collins, CO 80521 (McCue); Rood and Riddle Equine Hospital, 2150 Georgetown Road, Lexington, KY 40511 (Scoggin); e-mail: patrick.mccue@colostate.edu.

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1. Introduction

A majority of equine uterine problems can be diagnosed using assessment of reproductive history and diagnostic techniques such as transrectal ultrasonography, vaginal speculum examination, uterine culture, uterine cytology, and endometrial biopsy.1–3 A videoendoscopic examination of the uterus, or hysteroscopy, can also be a valuable procedure to detect or confirm suspected uterine abnormalities, to obtain uterine samples for subsequent analysis, to be used as a therapeutic delivery modality, or to deposit semen at the uterotubular junction. Hysteroscopy is most valuable in the detection of pathologic abnormalities within the uterine lumen or endometrial surface that cannot be diagnosed by traditional diagnostic techniques. Abnormalities may include intrauterine adhesions, retained endometrial cups, localized lesions, and focal sites of infection. Pioneer studies on the use of hysteroscopy in the mare began in the late 1960s and continued through the early 1990s.4–8 Several recent reviews have described the endoscopy equipment, mare preparation, and general procedures for hysteroscopy.9–11 In general, a videoendoscope or gastroscope with a working length of 1 to 1.5 meters, an external diameter of 9.8 to 12.8 mm, and a biopsy channel size of 2.8 to 3.8 mm is recommended. The endoscope should be cold sterilized with 2.4% glutaraldehyde and subsequently rinsed with 0.9% sterile saline prior to use. The mare should be restrained in examination stocks and sedated (i.e., with a combination of detomidine hydrochloride and butorphanol tartrate), and a thorough cleansing of the perineum should be performed prior to the procedure. Insufflation of the uterine lumen is required for optimal visualization during the examination. The goal of this review is to describe how hysteroscopy can be utilized in equine practice as an adjunct diagnostic or therapeutic modality.

2. Detection of Intrauterine Adhesions

Adhesions across the lumen of the uterus are uncommon and occur secondary to dystocia or obstetrical procedures used to resolve a dystocia.12–15 Intrauterine adhesions are difficult to
diagnose on transrectal ultrasound but may become visible if fluid (i.e., sterile saline or lactated Ringer’s solution) is infused into the lumen to distend the uterus. The best method for detection of intrauterine adhesions is videoendoscopy (Fig. 1).5,8

3. Detection of Uterine Trauma

Trauma to the uterus can occur during an apparently normal foaling, during a dystocia with or without obstetrical manipulations, or as a consequence of a surgical procedure such as a cesarean or ovariec-tomy.16–18 Diagnosis of uterine trauma may be based on reproductive history, clinical signs, transrectal and/or transabdominal ultrasonography, laparoscopy, abdominocentesis, manual evaluation of the uterine lumen, and videoendoscopic evaluation of the uterine lumen (Figs. 2 and 3). Obtaining an accurate diagnosis is key to formulation of a therapeutic plan and prognosis for recovery and future fertility.


Primary uterine tumors are rare in the horse and would include leiomyomas, leiomyosarcomas, lymphosarcomas, adenocarcinoma, and other
tumors. Videoendoscopy can be used to visualize intralumenal and intramural masses, obtain small biopsies, facilitate accurate location for collection of a larger biopsy sample, or facilitate removal of pedunculated masses (Fig. 4).8,19–26

5. Detection of Focal Areas of Infection or Inflammation

A general presumption is that a uterine infection is evenly distributed throughout the uterus. However, endometritis may be associated with localized, discrete adherent plaques or regional areas of bacterial or fungal infection.1,27 Videoendoscopy can help identify areas of infection and allow for sample collection (culture, cytology, biopsy) from affected areas (Figs. 5 and 6).

6. Evaluation of a Mare with Pyometra

The term pyometra, as used in horses and cattle, refers to the accumulation of a large volume of inflammatory fluid associated with a chronic infection.28,29 An open pyometra is associated with a patent cervix and a chronic or intermittent vaginal discharge. In contrast, a closed pyometra implies that the cervix is not patent (i.e., closed or adhered shut), in which case there is no vaginal discharge despite accumulation of a large quantity of fluid in the uterus. A videoendoscopic examination can be used to evaluate patency of the cervix (Fig. 7), the presence of vaginal or cervical adhesions (Fig. 8), or...
accumulation of cloudy fluid within the uterus (Fig. 9) in affected mares.

7. Detection of Persistent Endometrial Cups
Persistence of endometrial cups has been described in mares with an early termination of pregnancy, such as fetal loss or abortion, and mares that carried a normal pregnancy to term. Persistent endometrial cups have been associated with failure to show behavioral estrus, complete ovarian inactivity, sporadic follicular growth, and luteinization of partly developed follicles. Diagnosis is based on observation of endometrial cups on ultrasonography per rectum, videoendoscopic evaluation of the uterine lumen (Fig. 10), and/or measurement of equine chorionic gonadotropin in peripheral blood. The functional life span of persistent cups has been reported to be 6 to 30 months.

8. Detection and Removal of Foreign Bodies
Occasionally, a foreign body will be located within the uterine lumen of a mare. Foreign bodies or substances found within the uterine lumen of mares include a mummified fetus or fetal parts, the tip of a uterine culture instrument (Fig. 11) that fractured off during sample collection, a marble intentionally placed in the uterus in an attempt to block behavioral estrus (Fig. 12), and residues or precipitates from intrauterine medications. Initial detection may be made by recognition of an echogenic object casting a shadow during transrectal ultrasonography. Videendoscopy can subsequently be used to confirm the diagnosis and facilitate removal using a grasping instrument or basket passed down the biopsy channel (Figs. 13 and 14).
9. Detection and Removal of Fetal Remnants

Death of an embryo or fetus early in gestation usually results in complete resorption or expulsion of the fluids and tissues. However, in some instances, fetal tissues may remain in the uterine lumen.8 Fetal death later in gestation usually results in abortion of the fetus, but on rare occasions, retention and subsequent mumification of the fetus may occur.34 Initial indication of the retention of fetal tissue may be obtained by transrectal ultrasound visualization of an echogenic mass casting a shadow, and videoendoscopy can be used to confirm the diagnosis.35 Smaller fetal remnants can be removed using either a grasping instrument or basket passed down the biopsy channel of a videoendoscope (Fig. 15).

10. Detection and Removal of Endometrial Lymphatic Cysts

Endometrial lymphatic cysts develop secondary to deposition of fibrosis around endometrial lymphatic ducts and decreased myometrial contractility normally responsible for movement of lymphatic fluid through the duct system.7,8,38 Lymphatic cysts may be solitary or occur in clusters and range in size from a few millimeters to greater than 5 cm. The incidence of lymphatic cysts in mares increases with advancing age.7,36,37 Clinical diagnosis is made by transrectal ultrasonography, but endoscopic evaluation of the uterine lumen can also be used to detect endometrial cysts (Fig. 16) as well as facilitate temporary deflation (Fig. 17) or more long-term destruction (Fig. 18) of the cysts by laser therapy.8,39-42
11. Confirmation of the Presence of Urine in the Uterus

Vesico-vaginal reflux, or urine pooling, in the cranial vagina may lead to contamination of the uterus with urine during estrus when the cervix is open and relaxed onto the floor of the vagina.\textsuperscript{43,44} Urine contamination of the uterus leads to a chemical-induced endometritis and results in decreased pregnancy rate or decreased ability to maintain a pregnancy. Urine in the uterus may be recognized on transrectal ultrasound as a turbid, highly echogenic fluid usually at the base of a uterine horn or in the uterine body. Confirmation of urine contamination of the vagina and uterus may be made by vaginal speculum examination and videoendoscopy of the uterus, respectively (Fig. 19).

12. Hydrotubation of the Utero-Tubular Junction

The oviduct or uterine tube is an important link from the ovary to the uterus and is the site of fertilization \textit{in vivo}. The equine oviduct may become obstructed by masses of collagen, fibroblast cells, and other debris, which may lead to a reduction in fertility.\textsuperscript{45–47} Diagnosis of uterine tube pathology is usually made by exclusion once other potential causes of subfertility have been ruled out. A procedure termed “hydrotubation” has recently been developed in which the uterine papillae is cannulated and the uterine tube flushed in a retrograde fashion.\textsuperscript{48} The hydrotubation procedure has been used clinically as a technique to remove presumptive oviductal masses and restore fertility potential in mares with unexplained infertility (Fig. 20).\textsuperscript{49–51}
13. Detection of Congenital Uterine Abnormalities

Congenital abnormalities of the equine cervix and uterus are very rare. Abnormalities may include segmental aplasia of the uterus, uterus didelphys, uterus unicornis, double cervix connected to separate uterine horns (uterus bicorpor bicollis), and neoplasia or metaplasia. Disorders of sexual development may be associated with an underdeveloped reproductive tract, a complete absence of reproductive tissue of Müllerian duct origin, or incomplete development of the reproductive tract. Congenital neoplastic or metaplastic conditions are also highly uncommon but should be considered in maiden mares with detectable abnormalities in their reproductive tract. Videoendoscopic examination is an important diagnostic procedure to evaluate the integrity of the reproductive tract of affected mares.

14. Deep Horn, Low-Dose Insemination

Traditional artificial insemination with fresh semen involves deposition of 500 million progressively motile spermatozoa into the uterine body to achieve maximum reproductive efficiency. Insemination of a small volume of semen containing a low number of spermatozoa has been reported to yield a higher pregnancy rate if deposited onto or adjacent to the utero-tubular junction (UTJ) ipsilateral to the preovulatory follicle. A low dose of semen can be deposited using a manual transrectally guided deep horn approach or using a videoendoscope to visualize and deposit semen directly onto the UTJ via a catheter passed through the biopsy channel (Fig. 21).

15. Evaluation of Endometrial Health

Videoendoscopy can be used to visualize the entire surface of the mucosal or luminal surface of the equine uterus, allowing for gross evaluation of coloration, vascular patterns, focal sites of infection, localized lesions, scarring, and other surface abnormalities. Videoendoscopic evaluation of small arteries visible under the endometrium was noted to be correlated with age-related sclerotic changes of the endometrial vasculature determined by histopathology. It was suggested that endoscopic evaluation of the uterus could be used as a noninvasive technique to estimate the degree of endometrosis and provide a prediction for reproductive ability of mares. In addition, narrow-band imaging through a videoendoscope was reported to allow for recognition of an endometrium affected by endometrosis and vessel degeneration subsequently confirmed by histopathology.

16. Summary

Hysteroscopy is a procedure that can be used in the diagnosis and treatment of uterine abnormalities. Videoendoscopy of the uterus can be used diagnostically for detection of uterine issues such as intralumenal adhesions and persistent endometrial cups, as well as directed biopsy of focal uterine lesions or masses. Therapeutically, hysteroscopy can be used in the identification and removal of foreign bodies, temporary ablation of lymphatic cysts, hydrotubation to alleviate oviductal blockage, and low-dose insemination at the utero-tubular junction. It should be noted that the procedure can be associated with iatrogenic infection or inflammation.

Acknowledgments

Declaration of Ethics

The Authors have adhered to the Principles of Veterinary Medical Ethics of the AVMA.
Conflict of Interest
The Authors have no conflicts of interest.

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