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Endoscopy Guided Photoablation of Endometrial Cysts using a 980 nm Laser with a Contact Fiber in Mares

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Citation

Ponthier, J., de la Rebière, G., Salciccia, A., Deleuze, S. Endoscopy Guided Photoablation of Endometrial Cysts using a 980 nm Laser with a Contact Fiber in Mares. *J. Vis. Exp.* (161), e61569, doi:10.3791/61569 (2020).

Date Published

July 16, 2020

DOI

10.3791/61569

URL

jove.com/video/61569

Abstract

In mares, endometrial cysts are associated with endometriosis and can cause maternal recognition failure or compromise and delay pregnancy diagnoses. Historical treatments were invasive and had adverse effects on the endometrium. Hysteroscopically guided laser therapy is easy and effective for endometrial cysts resection, with no deleterious effects for the endometrium.

A 110 cm long and 1.0 cm wide endoscope is sterilely introduced in the uterus through the open cervix of an estrous mare after vulvar cleaning. The uterus is slowly infused with less than 1 L of physiologic solution and the laser fiber is inserted in the biopsy canal of the endoscope. Cysts are then cauterized with the 980 nm diode laser with a contact fiber set at 20–2 5W in continuous mode. Each cyst is punctured until complete voiding of the cyst and shrinking of the cyst wall around the fiber. Uterine lavages with sterile saline solution are performed directly after the surgery and for one or two days as non-inflammatory fluid can be observed.

This procedure is easy and quickly performed, with no obvious deleterious effects. Cysts resection makes ultrasound pregnancy diagnosis easier and, in some cases, could restore proper embryo migration in the uterine horns between day 6.5 and 17. However, this treatment does not improve the underlying histological lesions related to endometriosis. These considerations should be clearly expressed to the breeder before this procedure.

Introduction

Endometrial cysts in mares were histopathologically described in the seventies by Kenney[1]. In the late eighties, the use of hysteroscopy and ultrasonography led to their clinical description and helped to understand their consequences on fertility[2,3,4,5].

In the early stages, endometrial cysts have been associated with a degeneration of the endometrium now called

endometrosis[1,3,4,6,7,8] and it is currently accepted that small (<1 cm) cysts are related to endometrial glands fibrosis when larger cysts are related to lymphatic dilatation[6]. These large cysts are the most likely to disturb equine embryo migration between day 6.5 and day 17, thus decreasing the fertility by impairing maternal recognition[1,3,4,6,8]. Endometrial cysts may also interfere with early pregnancy diagnosis, especially if they are round and have a size similar to that of an embryonic vesicle[3,4,6,9] (see **Figure 1**). Thus, they can potentially increase the interval between two inseminations by delaying first embryo ultrasonography and twin gestation assessment (see **Figure 2**). Endometrial cysts may also interfere mechanically with fluid collection during uterine lavage performed to treat endometritis or to collect the embryo. Consequently, endometrial cysts have effects on observed mare's fertility, with potential economic consequences in breeding farms.

Besides attempts to treat the underlying endometrosis[10], endoscopically-guided focal treatments of cysts have been proposed. Electrosurgical cauterization has been described, but heat exposure could injure the endometrium around the cyst[11]. Aspiration of the cyst is only efficient if the secreting structure is no more active at the time of the puncture[12]. Laser irradiation with a 980 nm diode laser with a contact fiber seems to show smaller subsequent endometrial scars[6,13]. Improvement of laser devices and procedures[6] now allows us to propose this safe and efficient technique in equine clinical practice. However, mare owners must be informed about the limits of this option. Photoablation of the cysts will increase embryo recognition in some mares, will advance the pregnancy diagnosis in some cases and could limit the negative mechanical effect of endometrial cysts on uterine lavage performed to treat endometritis or to collect embryos. However, it will never treat the concomitant underlying endometriosis or endometritis.

This report aims to describe an efficient procedure to perform hysteroscopy-guided diode laser cyst ablation in mares. Preparation and procedures will be practically described for a clinical application.

Protocol

The presented protocol is used for mares presented in the equine hospital and follows institutional animal care guidelines.

NOTE: Perform endometrial cysts photoablation before anestrus: heats observed in late July or August thus seem most reliable. Do not perform this procedure too late in the breeding season as it can limit the number of estruses available to treat a potential endometritis.

1. During the preceding estrus

1. Perform a complete breeding soundness examination of the mare, including an endometrial biopsy[1] (not described here) to ensure that the mare can potentially get pregnant after the procedure.
2. In case of poor endometrial biopsy staging according to Kenney's classification[1], give the embryo transfer or intra cytoplasmic sperm injection (ICSI) program preference over endometrial cysts photoabalation.

2. During the preceding diestrus

1. Once the rectum is empty, count, measure and map endometrial cysts of the mare in the uterus using trans-rectal ultrasonography guided by rectal palpation with a

7.5 or 5 MHz linear rectal probe and calipers on the screen (**Figure 3**) in a contention stock.

2. Administer 250 µg of cloprostenol intra-muscularly to induce estrus within 2 or 3 days after day 6–7 post-ovulation.
3. On a daily basis, perform common routine ultrasonography and cervix palpation to observe estrus signs, including significant endometrial edema, antral follicle of 35 mm and softened and opened cervix.

3. Preparation when the mare is in heat

1. Restrict access to the operation room to people wearing eye protection glasses.
2. After emptying of the rectum, wrap the tail and clean the vulva aseptically using iodine-povidone.
3. To ensure easy manipulation and comfort of the mare, administer detomidine (10 µg/kg) and butorphanol (0.1 mg/kg) intravenously in the jugular vein with a 21 G needle.
4. Per vagina, install the embryo collection catheter through the cervix and insufflate the balloon with 40 mL of air.
5. Infuse the uterus with 1.5 L of sterile saline solution (0.9% NaCl) to inflate the uterus.
6. Deflate the balloon and remove the catheter.
7. Pass the endoscope aseptically through the cervix within a sterile sleeve.

4. Technique

1. Connect the 600 µm quartz fiber to a diode laser operating at 980 nm. Set the power at 20–25 W in continuous mode.
2. Pass the flexible quartz fiber via the biopsy channel of a 10 mm diameter video-endoscope until 3–4 cm of free fiber can be identified on the screen. A minimum of 10 mm from the end of the fiber should be visible.
3. Activate the laser to puncture the cyst ideally at its apex: a dedicated pedal is available on the device to keep hands free. In some cases, multiple punctures at various locations are necessary to achieve complete voiding of the cyst. The cystic fluid is passively drained out into the uterus.
4. After the cyst lining has collapsed around the fiber, deploy the laser until the membrane shrinks.
5. Perform transrectal ultrasonography of the uterus as many times as necessary during the procedure to confirm that endometrial cysts have disappeared.

5. Post-operative treatments

1. Administer general antibiotic treatment: 22,000 UI/kg penicillin-procaine suspension, intra-muscularly, twice a day, for 3 days.
2. Just after intervention, perform uterine lavage as described above (see steps 3.4-3.6).
    1. Collect the liquid infused in the uterus before the endoscopic procedure through a sterile cuffed catheter.
    2. Flush the uterus with successive instillations of 1 L sterile isotonic solution (0.9% NaCl) until a clear liquid is collected.
    3. At the end of the procedure, administer 20 IU of oxytocin intra-muscularly.
    4. Perform transrectal ultrasonography of the mare uterus the day after: intraluminal free liquid is frequently observed (see step 2.1).

3. As long as free intra-luminal fluid is observed by transrectal ultrasonography and until the end of the heat, perform uterine lavages daily with the procedure described above (steps 3.4-3.6). Sometimes, serum-like, limpid and yellow stained liquid is collected for several days.

   NOTE: Giving repeated intra-muscular injections of oxytocin (20 IU) every 4 h or less when the mare is in estrus can avoid fluid accumulation and reduce the risk of bacterial contamination in the uterus.

4. Perform trans-rectal uterine ultrasonography during the following diestrus to confirm disappearance of endometrial cysts and the absence of intraluminal free fluid.

   NOTE: If free intraluminal fluid is observed, prostaglandin injection is recommended to induce a new estrus, to diagnose an eventual subsequent endometritis and to treat it.

Representative Results

Surgeries were performed on mares having cysts with diameters over 15 mm. However, if other smaller cysts were also present, photoablation of the other cysts was attempted. Generally, these large cysts were at the bifurcation or the basis of the horns. However, some of them were present in the body of the uterus and were equally treated.

In our experience, intraluminal cysts are very easy to localize with the endoscope. Moreover, performing this procedure in saline solution increases the visibility inside the uterus: it avoids emission of vapors, foam production due to endometrial mucus and lymphatic liquid mixing. Manual closure of the cervix while maintaining and guiding the endoscope helps to keep the liquid inside. Trans-rectal manipulation of the endoscope in the uterus can sometimes help to guide the endoscope into the desired horn. Thereafter, laser intervention is quite easy and quick, with a maximum treatment time of 5 min per cyst, depending on the size and on presence of inner walls or loculations that may require multiple laser activations for the same structure. The direct contact decreased the overall temperature in the uterus. Parietal cysts were more difficult to identify, because of their localization and their smaller size (see **Figure 4**). In some cases, it was impossible to visualize (with the endoscope) the parietal endometrial cysts previously identified by transrectal ultrasonography. However, only the smallest parietal cysts were impossible to treat, but they do not interfere with the embryonic vesicle's movements and are not easily confused with day-14 embryos, because of their size and localization. No direct surgical complications have been observed after the performed procedures.

Liquid accumulation was frequently observed by ultrasonography for several days after surgery. However, the collected liquid was clear and yellow and no inflammatory cells were observed on endometrial swabs. We attributed this feature to lymphatic fluid accumulation in the uterus after the opening of the cysts. Routine lavage procedures and repeated oxytocin boluses were sufficient to treat this condition before the end of estrus.

Delay between breeding and pregnancy diagnosis was shortened by decreasing the number of large size cysts. In a mare, the diagnosis was made possible again at day 14, whereas before treatment, it was only possible after day 24 or day 32 when cardiac activity or embryo migration could be respectively assessed. While laser treatment of endometrial cysts has obvious advantages, concluding about its direct effect on fertility would be dangerous, because of

the many factors impacting fertility and even the birth of a foal the following season would not allow a statistically valid conclusion.

Figure 1: Day 14 embryonic vesicle (~14 mm diameter). Normal appearance of an embryo observed on early pregnancy diagnosis. Please click here to view a larger version of this figure.

Figure 2: Day 14 embryonic vesicle and endometrial cyst. The embryo (above) is attached to the endometrial cyst (below). Please click here to view a larger version of this figure.

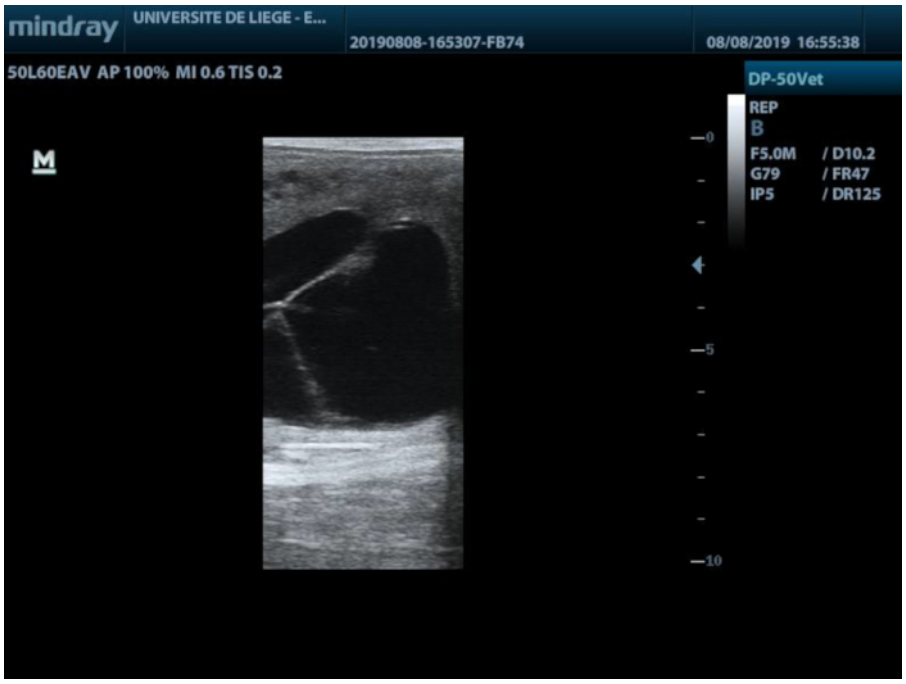

Figure 3: Endometrial cysts in diestrus. Multiple cysts in the bifurcation of the horns of a non-pregnant mare (measure scale on the right side is in centimeters). Please click here to view a larger version of this figure.

Figure 4: Small parietal endometrial cyst. The mare is non-pregnant and in diestrus (scale bar is on the left side is in centimeters). Please click here to view a larger version of this figure.

Discussion

Hysteroscopy and laser photoablation of endometrial cysts is an easy procedure to reduce large intra-luminal cysts in the mare, as previously suggested[14]. Technically, this method is improved when performed on a mare in estrus. Inflating the uterus with sterile saline solution improved visibility when compared to air filling and continuous aspiration while performing the procedure. Small intra-parietal cysts (<10 mm) are more difficult to reach and to treat. Moreover, treating these small cysts could lead to piercing of the endometrium and myometrium if laser treatment time is prolonged. However, they seldom interfere with the embryonic vesicle's mobility and the early pregnancy diagnosis, due their localization and their size[6].

Reducing numbers of intra-luminal large cysts under hysteroscopic control with the laser[6] improves the mare's annual fertility by reducing the interval between breeding and pregnancy confirmation. On day 14 post-ovulation, ultrasonographic presence of a ~14 mm diameter anechogenic embryo is used to confirm gestation, or, if it is not observed, leads to use the next heat to inseminate or breed again[9, 10]. However, large and/or multiple endometrial cysts can delay this decision, because embryos may be hidden by endometrial cysts or confused with them[6, 9, 10], thus limiting opportunities to get the mare pregnant, due to unexploited heats happening between two ultrasonographic controls. Hysteroscopy and laser ablation of cysts makes the day-14 pregnancy diagnosis possible again in mares that had large endometrial cysts, and thus maximizes the number of attempts, as recommended to manage difficult mares[10]. It also decreases the risks of an inadequate twin pregnancy diagnosis or to miss such a pregnancy.

Assessing a statistical effect of hysteroscopy and laser resection of endometrial cysts on observed fertility is very hazardous: several management factors can vary before and after surgery making comparison impossible. However, embryo migration between day 6.5 and day 16-17 could be mechanically impeded by large endometrial cysts[1, 4], and this incomplete uterine pregnancy recognition can lead to premature luteolysis and early pregnancy loss[15, 16, 17]. In this case of mechanical obstruction, photoablation of cysts can effectively decrease embryonic losses and improve the fertility of the mare.

However, laser resection of cysts cannot resolve the underlying causes of infertility such as endometritis or endometriosis. Response to the treatment can be disappointing when these conditions are present as they are more likely to be the cause of the poor fertility than the cysts themselves. Complete breeding soundness examination, including endometrial biopsy[1, 10], should be performed prior considering cyst ablation by laser in order to exclude the presence of endometrial pathologies and to define their prognosis. Any other condition compromising the mare's fertility should be first treated, and alternatives such as embryo transfer or ICSI program should be proposed when applicable. Hysteroscopically guided endometrial cysts resection with laser is solely of interest when the endometrial cysts delay the pregnancy diagnosis or interferes with embryo migration and recognition.

Disclosures

All authors are fully employed by Equine Clinic of Liège University and have no conflicts of interest with any company trading one of the products mentioned above.

Acknowledgments

Authors would like to thank Mr. Pascal Lejeune for his technical support during all procedures.

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