Large Animal VETERINARY Rounds

Now available on the Internet
www.canadianveterinarians.net/larounds

APRIL 2002
Volume 2, Issue 4

AS PRESENTED IN THE ROUNDS OF THE DEPARTMENT OF LARGE ANIMAL CLINICAL SCIENCES OF THE WESTERN COLLEGE OF VETERINARY MEDICINE, UNIVERSITY OF SASKATCHEWAN

Dystocia in Mares

Claire Card DVM, PhD, diplomate ACT

Foaling is an exciting time for horse breeders. It represents the culmination of a journey that began 1 year before with a search through pedigrees and performance records. The journey usually involved the transportation of the mare or semen to enable the mare to become pregnant and was followed by pregnancy evaluations, vaccinations, and foaling preparations. Owners patiently await the arrival of their new foal at the end of an almost year-long gestation. Many horse owners have a large emotional investment and attachment to the foal even before it is born. While 90% of all foaling proceed without intervention, the remaining 4% to 10% present a major clinical challenge. Dystocia in mares is a difficult challenge because of the vigorous nature of foaling, the potential for fatal complications, and the fact that the life of the mare and foal often lie in the hands of the practitioner. This issue describes techniques to predict foaling and methods for obstetrical manipulation that can be used in the field.

Causes of dystocia in mares

The most common cause of dystocia in mares is an abnormality in fetal positioning, where one limb is flexed, usually at the carpus. Other commonly encountered problems include: the head back position, poll lock, posterior presentation, transverse presentation, and failure of the foal to rotate into the birth posture so that the forelimbs are pushed into the birth canal upside down.[1,2] Unlike cattle, absolute fetal oversize is rare in the mare. The absence of fetal oversize problems in mares was illustrated by classic studies showing that pony mares bred through artificial insemination with semen from draft stallions were able to foal without assistance.[3] In addition to fetal malpositioning, premature placental separation, abortion, twin pregnancy, placentitis, and fetal abnormalities such as congenital hypothyroidism, limb contracture, and hydrocephalus are also associated with dystocia.

Monitoring foaling mares

One of the key features of a successful foaling outcome is the observation of parturition and timely intervention when needed.[4] There is a wide range of normal gestation in the mare, with 320 – 365 days considered within the normal range. This wide range in the normal length of gestation makes the prediction of the foaling date problematic. Mares are also considered to be notoriously cunning in avoiding observation during foaling and perhaps exert some voluntary control over the onset of the second stage of labour. Recent studies show that there are specific changes in prefoaling mammary secretions that help predict the approximate timing of parturition.[5] Calcium levels in prefoaling mammary secretions rise dramatically in the last few days before parturition.[6] In addition, in the last 24 hours before foaling, mammary secretion concentrations of sodium and potassium cross over, with sodium falling and potassium rising (Figure 1).

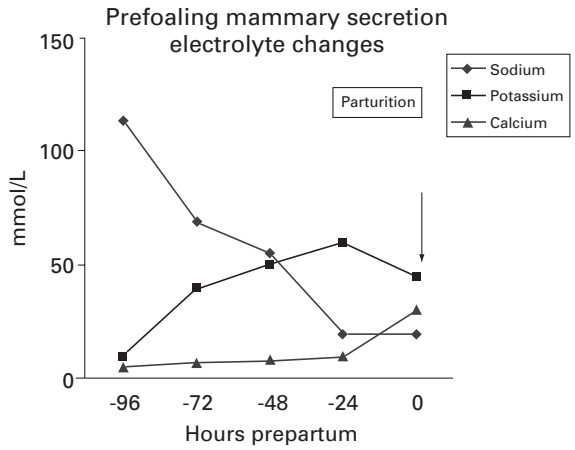
WCVM
Western College of Veterinary Medicine

University of Saskatchewan

Western College of Veterinary Medicine
Department of Large Animal Clinical Sciences
52 Campus Drive
University of Saskatchewan
Saskatoon, Saskatchewan S7N 5B4

The Canadian Veterinary Medical Association recognizes the educational value of this publication and provides support to the WCVM for its distribution.

Figure 1: Example of prefoaling mammary secretion electrolyte concentrations in a mare monitored daily before foaling



Mammary secretion analysis

A variety of commercial prefoaling mammary secretion test kits are available to analyze mammary secretions. To perform these tests a small amount (eg, 0.5 mL) of mammary secretion is obtained from the udder once a day. Sampling udder secretions does not result in irritation or mastitis. The mammary secretion is diluted in distilled or de-ionized water using a ratio of 1 part milk to 5 parts water (1:6 dilution). Generally, testing of the prefoaling mammary secretion is advised in the 10-14 days prior to the expected foaling date.

A conventional chemistry analyzer can measure concentrations of calcium, sodium and potassium in diluted mammary secretions. Calcium levels >10 mmol/L indicate impending foaling. If the chemistry analysis also detects the crossover of sodium and potassium, then foaling will occur in the next 24 hours, in many cases (Figure 1).

Water-hardness test kits, available from veterinary suppliers, quantify both calcium and magnesium. The results are provided in terms of units of calcium carbonate equivalents, also referred to as alkaline earth ions. When the diluted mammary secretion results in all 4 green squares on the test strip turning pink at 1 minute there is >370 mg/L of calcium (in equivalent alkaline earth ions) in the secretion. Studies have shown that when this level of calcium is reached, about 75% of mares will foal within the next 72 hours.

A commercial, foal-watch test kit measures calcium alone in units of calcium carbonate; diluted samples with >200 ppm indicate impending foaling.

There are a few individual mares that will foal with essentially no prepartum mammary secretion, and therefore a prefoaling sample cannot be obtained. Some mares have been reported to foal when only 3 of the 4 water hardness strip squares have turned pink, and of course, some mares wait for 6 or more days to foal after all 4 squares have turned pink.[6,7] However, in many cases, testing has allowed early and timely intervention in a setting of dystocia.

Pharmacologic agents

Sedatives and analgesics

One frustrating challenge that clinicians are faced with when working on a mare during dystocia is getting the mare to stand quietly during obstetrical manipulations. Due to the vigorous, forceful, and rapid nature of foaling, as well as the mare's sensitivity to the oxytocin released during vaginal manipulation, mares often react unpredictably and violently during a foaling. The development of potent analgesic and sedative agents such as a combination of detomidine (0.01 – 0.02 mg/kg) and butorphanol (0.02 mg/kg) given intravenously,[8] greatly assist foaling by providing effective sedation and analgesia for the mare. These drugs limit the ability of the mare to move and are good choices because they avoid hindend hypersensitivity. The potent analgesic activity of this drug combination limits the amount of sensation and pain the mare feels during manipulations. By immobilizing the mare, a rapid repositioning of a foal may be achieved that is often essential to the successful delivery of a live foal during a dystocia. The duration of analgesia with these drugs is about 20 minutes. Foals delivered from sedated mares seldom appear to be sedated after delivery and the main in utero effect is a reflex decrease in fetal heart rate because the drugs induce increases in uterine activity.[9]

Uterine relaxants

Uterine relaxant agents such as clenbuterol (300 µg/500 kg mare IV – administer slowly), a beta agonist, causes relaxation of the uterus that may allow obstetrical manipulations to occur without additional sedation.[10] The beauty of clenbuterol is its rapid onset of action following IV administration. This enables the veterinarian to decide quickly if the uterine relaxation induced by the agent will allow correction of the problem. This agent is particularly useful when repelling the foal in order to allow manipulation of its head or limbs. The long neck and the large size of the head of the equine fetus require much further and deeper repulsion than the equivalent repositioning of a fetal calf. The manipulation of contracted limbs or large foals is often performed more safely with the addition of clenbuterol because a relaxed uterus is less likely to tear or rupture during manipulation. Clenbuterol has been shown to induce a slight transient increase in fetal heart rate that is likely a compensatory response to decreased uterine blood flow and uterine relaxation. Clenbuterol may be used during dystocia in combination with sedatives, analgesics, and tranquilizers. The uterine relaxant effects of clenbuterol are more

potent than the alpha agonist effects of xylazine and detomidine, hence, the drug is effective even in sedated mares.

General considerations

During the extraction of the foal it is important to avoid excessive force. Generally, one individual should help guide the foal through the birth canal, while no more than 2 other individuals apply traction to the obstetric chains or ropes. Double loops on the chains with one loop on the pastern and one above the fetlock are preferred to spread the force applied by traction over a larger surface area on the foal's leg. Alternating traction on 1 limb and then the other may help to engage the shoulders of the fetus one at a time. In a standing mare, traction should be applied in the direction of the mare's hocks. When both shoulders are in the pelvis, the passage of the head may be facilitated by spreading the foals forelegs apart and pushing the foal's head down into the space. Once the foal's hips have cleared, traction should cease to avoid premature tearing of the umbilicus and uterine prolapse. Excessive force during fetal extraction may result in fetal asphyxia, death of the foal, mare mortality, uterine rupture, uterine heatoma formation, or uterine prolapse.

Equine clinics, referral centres, and veterinary schools have developed methods to assist with the management of equine dystocia. Because fetal oversize is seldom the underlying cause of dystocia in mares, a rapid means of correcting a fetal malpresentation may save the veterinarian time and increase the likelihood of delivering a live foal. If sedation and the use of uterine relaxants are unsuccessful in correcting dystocia during an assisted vaginal delivery, a controlled vaginal delivery under general anesthesia is usually recommended as the next step. Previously, the only options for dystocia that could not be corrected by manual means were euthanasia of the fetus for fetotomy, cesarean section to deliver the foal, or euthanasia of the mare and her fetus. All of these options had drawbacks, including loss of the fetus, loss of the mare, the cost, and the potential need to refer the mare for cesarean section. In addition, the prolonged time and trauma induced by excessive manipulation or undue pressure exerted in the birth canal during transport, often resulted in permanent damage to the mare's reproductive tract.

Controlled vaginal delivery

Controlled vaginal delivery places the mare under general anesthesia to correct a dystocia. The mare is anesthetized using similar induction protocols to those used for castration; premedication with xylazine 1 mg/kg or detomidine 0.01 mg/kg along with butorphanol at 0.02 mg/kg, followed by induction with ketamine at 2 mg/kg.[11] Some prefer to give the butorphanol following anesthesia with ketamine, to gain a smoother induction. The use of these drugs usually provides about 20 minutes of general anesthesia. If the mare is too lightly anesthetized or if the veterinarian needs more time, one-half of the initial dose of the medication can be administered by IV again. Further relaxation or a longer duration of anesthesia in the mare may be achieved with guaifenesin 50 mg/mL dissolved in 5% dextrose (GG), or the use of a "superdrip" (0.5 mg/ml xylazine, 1 mg/ml ketamine, guaifenesin 50 mg/ml in 5% dextrose administered at 2.5 ml/kg/hr).[8,12]

Once the mare is anesthetized, her front end is positioned in lateral recumbency, and her back end is lifted about a foot off the ground. This can be accomplished using a block and tackle, a hoist, a tractor with a front-end loader, a bobcat, a strong beam or tree, or a truck (Figure 2). Mountain equipment companies carry heavy weight stress tested D–rings, clips, and rope that can withstand even a draft mare's weight. These or sturdy ropes may be applied to the mare's pasterns to lift her up. The uterus is then pumped full of lubricant (eg, methylcellulose [sleeve lubricant]) and the foal repositioned. Once the foal is positioned correctly, the mare's hindquarters are lowered to the ground and the foal is pulled. Following any resuscitation efforts needed on the foal, the mare's uterus is lavaged using a large bore stomach tube and stomach pump with copious amounts of a 0.1% providone iodine solution. The mare is then administered oxytocin (20–40 IU IM or IV) to help the uterus contract and expel the placenta and residual fluids.

The main advantages of this technique are that general anesthesia makes the mare incapable of pushing against the efforts of the obstetrician and gravity facilitates the repositioning of the foal. Other advantages include the avoidance of trauma by rapidly completing the foaling, or when required, the fetotomy. Controlled vaginal delivery often allows the manipulation of contracted limbs safely into the pelvis, and may provide a treatment option in cases where the foal cannot be delivered by assisted vaginal delivery or fetotomy. Disadvantages of controlled vaginal delivery include the inconvenience of general anesthesia, and the potential for other complications such as cervical or uterine trauma, uterine rupture, hematoma formation etc.

Fetotomy

In order to perform a fetotomy the fetus must be dead and the mare's cervix fully dilated. All of the cuts should be made within the uterus and not the vagina. One or 2 cut fetotomies are generally well tolerated by mares. A high degree of hygiene during manipulations is necessary to prevent uterine infection. The process of sectioning the fetus with the wire saw generates a lot of heat. It is important to use copious amounts of lubrication in the uterus to diffuse the heat liberated during the sectioning. The lubricant will also fill the space between the foal and the uterine/placental tissues. A space between the uterus/placenta

Figure 2: Mare in position for manipulation during a controlled vaginal delivery

and the foal is necessary so that the obstetrician is able to verify the correct placement of the fetotomy wire on the fetus, and therefore avoids the accidental trapping of the uterus in the wire.[13] Full fetotomies carry a higher risk of inducing trauma to the mare, particularly if they take an excessive amount of time and as a result induce trauma in the reproductive tract. One of the difficulties encountered in mares is contracted legged foals where the limbs cannot be extended to place the fetotomy wire in the standard fashion, hence non-standard cuts may be required. The wire may need to be manually placed around the contracted limb using a wire retriever. The successful completion of a fetotomy is dependent on the mare's status, the working environment, the skill level of the obstetrician, the positioning of the fetus, the availability of help, and economic constraints. Skilled operators may be able to complete a full fetotomy, but it may not be the best option for the mare's future fertility. In situations where controlled vaginal delivery or cesarean section are inappropriate, then a full fetotomy may be elected to save the mare.

Partial fetotomy

We have used a partial fetotomy technique to assist the correction of dystocia and avoid excessive trauma to the mare. Many times this avoids the need for a full fetotomy. It is best attempted with the mare under heavy sedation. If the fetus is in the anterior presentation, one approach is to apply chains to any presenting limbs, repel the limbs deep into the mare, and find and deliver the head of the fetus through the vulva. A chain can be placed through the mouth of the fetus and around the poll. The long neck of the fetal horse allows the delivery of the head without the limbs. The head of the fetus can then be severed circumferentially at the atlanto-occipital joint with a scalpel blade. Placing traction on the head and pushing the vulvar tissue away from the head as the atlanto-occipital joint is cut open, facilitates the process of removal. A transecting cut through the atlanto-occipital joint should not leave any sharp protruding edges. Once the head is removed, the fetus is repelled and manipulation of the limbs can be performed. Without the head, the limb manipulations are easier and the foal is often easily pulled.

Dog-sitting position

One of the most difficult obstetric challenges is the dog-sitting presentation,[13] where the fetus is in the anterior presentation with both hind feet retained and perched on the pelvis of the mare. In this situation, often manual traction was applied, without success, to deliver the fetus. If the foal is alive, conversion to a posterior presentation is reported to be the best method to correct this malpresentation. If oxygen is readily available in a clinic situation, nasotracheal or nasal oxygen delivery may be initiated by passage of a nasal cannula and sewing or taping the tube into the foal prior to the maneuver. Clenbuterol should be administered (300 µg IV per 500 kg mare) to facilitate the procedure. General anesthesia may be required to complete the manipulation of the fetus. The obstetrician holds the foal's feet and the body is repelled back into the mare. The foal is then turned 45°- 90° and traction is applied to deliver the foal. Potential complications include laceration or rupture of the mare's uterus due to excessive traction.[14] This may occur prior to the veterinarian's visit when farm personnel are struggling to deliver the foal. Birth asphyxia and hindlimb contracture have been reported in surviving foals. If this procedure fails and the foal dies, techniques such as fetotomy are occasionally successful, allowing delivery by removing part of the hind limbs; however, mare mortality is reported to be high following fetotomy of foals in the dog-sitting position.

Case examples

Case 1

A 4-year-old miniature horse with the chief complaint of dystocia was referred to the Large Animal Hospital at the Western College of Veterinary Medicine. The mare had been observed attempting to foal the day before. On physical examination, a large amount of placenta and abnormal blood-tinged fluid

was observed coming from the mare's vagina. The mare was intermittently straining and crashed to the floor during the initial examination. She was estimated to weigh 150 kg and her temperature, pulse, and respiration were 38.5°C, 44 bpm, and 36 breaths per minute, respectively. Her mucus membranes were injected and the capillary refill was greater than 3 seconds. She was estimated to be 7% dehydrated. An IV catheter was placed into the jugular vein and lactated Ringer's solution administered. To facilitate further examination, the mare was sedated with detomidine (0.05 mg) and butorphanol (0.02 mg/kg), and was given clenbuterol (60 µg). The perineum was cleansed and a large amount of lubricant was pumped into the uterus. The mare became heavily sedated and unaware of her surroundings. An obstetric examination showed a dead fetus in an anterior dorsosacral presentation with the head back to the right and both forelimbs flexed at the carpus. The head was delivered into the vagina and pulled through the vulva. An obstetric chain was run through the mouth and around the poll of the fetus. Gentle traction was applied to the chain and the head was removed using a scalpel blade to cut through the atlanto-occipital joint. The remainder of the fetus was repelled into the uterus and the forelimbs repositioned. The fetus was delivered with gentle traction and the placenta came with the fetus. The uterus was lavaged using a 0.1% providone iodine solution until the effluent was clear (15 liters). The mare began eating and drinking immediately following the completion of the obstetric manipulations. To ensure uterine involution and the removal of bacteria and debris, she was given 5 IU of oxytocin every 4 hours, for 6 treatments. In addition, she was given 6 liters of fluid overnight, 250 mg of flunixin meglumine, gentamicin (6.6 mg /g SID IV) 1.1 g, and 5 million units of sodium penicillin (22,000 IU/kg BID). She was discharged the next morning on procaine penicillin G, 0.25 g phenylbutazone powder for 4 more days, and 2 more days of gentamicin. A subsequent phone call indicated that the mare took a few days post-foaling to go back on full feed, but otherwise appeared to have completely recovered.

Case 2

A 12-year-old thoroughbred mare was presented in labour with a chief complaint of dystocia. An evaluation of the mare showed that her vital signs were as follows: temperature 39° C, pulse 60 bpm, and 36 breaths per minute. Mucous membrane color was pink and hydration status was normal. A quick obstetric examination showed that the fetus was alive, in an anterior dorsoabdominal presentation with the head back, but located deep within the abdomen. The mare was straining during the obstetric manipulations and clenbuterol was administered to facilitate the manipulation of the foal. The foal's forelegs were delivered into the vagina, crossed, and rotational force was applied to the forelimbs to turn the foal into an anterior dorsal sacral presentation. This manipulation is sometimes successful in bringing the head up and out of its deep lateral location so that an ear, corner of the eye, muzzle, or jaw may be used to reposition the head. The movements of the foal made the manipulation difficult. After 15 minutes without success in bringing the head around, a decision was made to anesthetize the mare. She was given IV xylazine (1 mg/kg), and butorphanol (0.02 mg/kg) for sedation; ketamine (2 mg/kg) was used for induction. The mare was positioned in lateral recumbancy and ropes were attached to her hind limbs. The mare's hindquarters were elevated about 30 cm off the ground by attaching the ropes to the front-end loader of a tractor. Within 5 minutes of induction, the foal was repositioned so that the head was in the birth canal. The mare was then lowered back into lateral recumbency and a live foal was extracted by traction on the obstetric chains. The mare's uterus was lavaged with a dilute 0.1% providone-iodine solution. She recovered in under 20 minutes and rapidly showed interest in the foal. Because of the potential for birth-related hypoxia due to dystocia, the foal was observed closely and initially tube-fed 400 mls colostrum. Supplemental oxytocin (40 IU) was given intravenously and intramuscularly to the mare to reverse the effects of clenbuterol, and the placenta was passed within 4 hours. The mare was given 40 IU oxytocin every 4 hours for 4 more treatments to stimulate removal of uterine debris. She was treated with intramuscular procaine penicillin (22,000 IU/kg BID) and 2 g phenylbutazone PO for 5 days. Further monitoring by rectal palpation revealed that the uterus was well involuted and the mare made an uneventful recovery.

These cases illustrate a more controlled means of managing dystocia in mares, allowing the veterinarian to maximize the speed of manipulation, optimize foal and mare survival, and provide a safer working environment for the clinician.

Dr. Claire Card is a full professor in the Department of Large Animal Clinical Sciences. She has been employed at the Western College of Veterinary Medicine since 1991. She has active research interests in equine and game farm animal reproduction.

Selected references

1. Vandeplasse MM. Dystocia. In: McKinnon AO, Voss J. Eds. *Equine Reproduction*. Philadelphia: Lea and Febiger, 1993:578-587.
2. Fraser GS, Perkins NR, Blanchard T, Orsini JA, Threlfall WR. Prevalence of fetal malpositions in equine referral hospital dystocias. *AAEP* 1996;42:320-321.
3. Allen WR, Wilsher S, Turnbull C, et al. Influence of maternal size on placental, fetal, and postnatal growth in the horse. I. Development in utero. *Reproduction* 2002;123:445- 453.
4. Embertson RM. Dystocia and cesarean sections: the importance of duration and good judgement. *Equine Vet J* 1999;31:179-180.
5. Rook JS, Braselton WE, Nachreiner RF, et al. Multi-element assay of mammary secretions and sera from periparturient mares by inductively coupled argon plasma emission spectroscopy. *Am J Vet Res* 1997;58:376-378.
6. Ley WB, Bowen JM, Purswell BJ, Irby M, Grieve-Crandell K. The sensitivity, specificity and predictive value of measuring calcium carbonate in mares' prepartum mammary secretions. *Theriogenology* 1993;40:189-198.
7. Ousey JC, Dudan F, Rossdale PD. Preliminary studies of mammary secretions in the mare to assess the readiness for birth. *Equine Vet J* 1984;16:259-263.
8. Lin HC, Wallace SS, Robbins RL, Harrison IN, Thurman JC. A case report on the use of guiaifenesin, ketamine, xylazine anaesthesia for equine dystocia. *Cornell Vet* 1994;84:61-66.
9. Luukkanen L, Katila T, KoskinenE. Some effects of multiple administration of detomidine during the last trimester of equine pregnancy. *Equine Vet J* 1997;29:400-403.
10. Card CE, Wood MR. Effects of acute administration of clenbuterol on uterine tone and equine fetal and maternal heart rates. *Biol of Reprod* 1995; Monograph 1:7-11.
11. Embertson RM, Bertrand WV, Hance SR, Smith S. Hospital approach to dystocia in the mare. *AAEP* 1995;41:13-14.
12. McCary JE, Trim CM, Ferguson D. Prolongation of anesthesia with xylazine, ketamine, and guaifenesin in horses: 64 cases (1986-1989). *JAVMA* 1990; 197:1646-1649.
13. Fraser G. Review of the use of fetotomy to resolve dystocia in the mare. *AAEP* 1997;43:262-268.
14. Baldwin J, Cooper W. Vanderwal D. Dystocia due to anterior presentation with unilateral or bilateral hip flexion posture ("Dog-sitting" Presentation) in the mare: incidence and outcomes. *AAEP* 1991;37:229-241.

Abstract of Interest

Effects of Acute Administration of Clenbuterol on Uterine Tone and Equine Fetal and Maternal Heart Rates

CLAIRE E. CARD AND MARGARET R. WOOD

Clenbuterol is a highly selective β_2 adrenergic agonist that has been used to induce bronchodilation and uterine relaxation in mares. The effects of clenbuterol on equine uterus and fetus have not been described. The objectives of this study were to determine the effects of acute maternal (n = 4) i.v. administration of clenbuterol on the fetus and uterus and on the maternal system. Trials were performed at 30, 40, 50, and 60 days of pregnancy and monthly thereafter until parturition. Fetal heart rate was determined using real-time B-mode transrectal or transabdominal ultrasonography. At time zero, 300 µg of clenbuterol or saline was administered. Fetal heart rate and maternal parameters (heart rate, respiratory rate, and uterine tone) were recorded at time - 3, + 3, + 15, + 30, + 60, and + 120 min. Saline administration had no effect. Basal fetal heart rate changed with gestation ($p = 0.000$) and was highest early in pregnancy (>220 beats/min [bpm]). It then decreased to 86 bpm near term [$(Y = 184.6 \bullet 10^{(-0.0x)})$ $R^2 = 0.70$]. Time ($p = 0.000$; $p = 0.021$) and clenbuterol treatment ($p = 0.041$; $p = 0.002$) transiently increased maternal (range 4 to 50 bpm) and fetal (range 10 to 69 bpm) heart rates, respectively. Basal uterine tone changed with gestation ($p = 0.000$). Clenbuterol ($p = 0.000$) and time ($p = 0.002$) significantly affected uterine tone, which decreased beginning 3 min after clenbuterol was administered until t = 120 min. Mares delivered live foals at term. The prolonged uterine effects, transient cardiovascular effects, and normal pregnancies suggested that clenbuterol may be used clinically to induce sustained uterine relaxation in pregnant mares throughout gestation without untoward negative cardiovascular effects.

Biology of Reproduction 1995; Monograph 1:7-11.

Upcoming Meetings

6-8 June 2002
The Western College of Veterinary Medicine June Conference
Saskatoon, SK
Contact: WCVM, U of S, Cont. Vet. Ed.
Tel.: (306) 966-7267
Fax: (306) 966-7274

17-20 July 2002
The 54th Annual Convention of the Canadian Veterinary Medical Association
Halifax, Nova Scotia
Contact: Angie Herzog
Tel.: (613) 236-1162, ext. 12
Fax: (613) 236-9681
Email: admin@cvma-acmv.org

21-26 July 2002
The 8th International Symposium on Equine Reproduction
Fort Collins, Colorado
Contact: Mrs. Janette Wade
Newmarket, U.K.
Tel.: +44 (0) 1638 667 600
Fax: +44 (0) 1638 667 229
Website: www.ivis.org/iser/

18-23 August 2002
The 22nd World Buiatrics Congress
Hannover, Germany
Website: www.wbc2002.de
Email: angelica.pietsch@tiho-hannover.de

Change of address notices and requests for subscriptions are to be sent by mail to P.O. Box 310, Station H, Montreal, Quebec H3G 2K8 or by fax to (514) 932-5114 or by e-mail to info@snellmedical.com. Undeliverable copies are to be sent to the address above.