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Understanding Equine Infertility

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UNDERSTANDING EQUINE *infertility*

NBC experts offer solutions to complex fertility issues

BY SALLY SILVERMAN

When it comes to producing a healthy foal, it's not always as simple as the birds and the bees. It can take a team to produce a viable neonate. The expertise and talents of five board-certified specialists in reproduction and behavior, collaborating with specialists throughout Penn Vet's New Bolton Center, are what make the Section of Reproduction and Behavior so exceptional.

"Capitalizing on the expertise of each clinician gives us a tremendous amount of collective synergy allowing us to provide the highest level of reproductive care for our patients," said Dirk Vanderwall, DVM, PhD, chief of the Section of Reproduction and Behavior. "We have veterinarians who are specialized in reproductive issues with mares as well as those who focus on stallions. Ours is one of the few veterinary programs to have a board-certified animal behaviorist [Sue McDonnell, PhD] integrally involved in our clinical program. And when non-reproductive medical or surgical issues adversely impact reproductive performance, we utilize the expertise of our colleagues who are specialists in other disciplines at New Bolton Center. We also have a superb intensive care unit that cares for mares at-risk during gestation along with the neonatal intensive care unit for foals once they are born."

So What's His Problem?

It is elementary biology: for a mare to get pregnant, sperm must fertilize an egg. Difficulties often begin with the stallion's inability to deliver viable sperm. The problem can be mechanical, reduced libido or poor sperm quality.

Above left, the semi-feral pony herd provides a valuable resource for studying reproductive behavior. Above right, a newborn foal in the NICU. Below, Dr. Vanderwall doing an embryo search in the lab.

At the Georgia and Philip Hofmann Research Center for Animal Reproduction at New Bolton Center, veterinarians work closely with behaviorist Sue McDonnell, PhD, founding director of the Havemeyer Equine Behavior Program at Penn Vet, as well as specialists from other areas of the hospital, to offer a comprehensive approach to the treatment of stallions with a variety of fertility problems. Ejaculatory problems might be the result of an irregularity in the stallion's reproductive organs, or an orthopedic problem that leaves him unable to mount a mare. The Sports Medicine and Imaging Section, with advanced imaging diagnostics including nuclear scintigraphy, MRI and ultrasonography, is onsite to help evaluate these issues. Recently, back issues prevented a prized show stallion from breeding. Using positive reinforcement, Dr. McDonnell trained him to ejaculate while just standing in a stall. Dr. McDonnell has also developed protocols for pharmacologically enhancing and inducing ejaculation.

Oh, Do Behave!

A 1,200-pound stallion in a state of arousal makes live breeding and semen collection for artificial insemination potentially dangerous activities.

The Penn Started Stallion Program involves highly skilled professional stallion handlers using positive-reinforcement methods, either at New Bolton Center or the owner's farm, to introduce the stallion to an organized, safe breeding routine. Session-by-session progress is charted using a scoring system for a number of specific handling goals and procedures.

"With our skilled handlers even an overly aggressive stallion can learn that we have a protocol, and, if he follows it, he will get to the goal," explained Dr. McDonnell. Stallion schooling is all done with positive guidance. "This is why the Penn Started Stallion program is so successful," said McDonnell. "Because we can bring them around in a positive way."

In addition to the Penn Started Stallion program, a two-day short course on stallion handling is offered twice yearly by the Havemeyer Equine Behavior Lab.

Improving Results

Poor semen quality is often the cause of unsuccessful breeding. Since 2010, Penn Vet has been enjoying notable success with semen optimization processing techniques. According to Regina Turner, VMD, PhD, associate professor, "We are applying and tailoring different techniques to meet the needs of individual stallions. The success that we have seen using this approach with a growing number of stallions has made a huge difference in the breeding careers of these animals."

Sperm motility issues, for example, can be due to "toxic" seminal plasma. By carefully separating sperm from the seminal plasma, then mixing them with a commercially available semen extender, Dr. Turner has seen pregnancy rates increase more than 70 percent.

Freezing semen for artificial insemination is an increasingly important part of the equine breeding business, and Dr. Turner, with clinical resident Candace Jacobson, DVM

and Maria Schnobrich, VMD, has also successfully applied processing techniques, such as filtering out abnormal sperm, to improve the quality of frozen semen for stallions classified as "problem freezers."

In 2011 the expertise of the clinicians was augmented with the addition of a state-of-the-art computer-assisted sperm analyzer, and a new fluorescent-based system for determining sperm concentration and viability. The new equipment allows for some of the most current and objective semen analysis services in the country.

Management for a Better Mom

The stallion is only half of the equation. Proper management of the mare is also required to produce a healthy foal. As the Director of New Bolton Center's Equine Endometrial Biopsy Service and a consultant for the high-risk pregnancy program, Patricia L. Sertich, MS, VMD says that a good breeding plan begins with a Breeding Soundness Exam (BSE). The exam provides information for optimal breeding management to give a mare the best chance of establishing pregnancy and delivering a healthy, normal foal. It involves a complete medical history of the mare; a thorough examination of the external genitalia; internal examination of the reproductive organs through palpation and ultrasound; culture of an endometrial swab; and histological evaluation of an endometrial biopsy sample. First developed at New Bolton Center, the technique used for histological evaluation of the endometrial tissue samples is used worldwide to evaluate the quality of a mare's uterus. Biopsy samples from across North America are submitted to the New Bolton Center lab for analysis.

In addition to these standard diagnostic procedures, when faced with challenging cases of mare infertility the clinicians at Penn Vet now also utilize procedures such as low-volume diagnostic uterine lavage, which enhances their ability to accurately determine whether a uterine infection is the underlying cause of the mare's infertility.

"While any pathologist can detect changes," explained Dr. Sertich, "a reproductive specialist is able to interpret the abnormalities in terms of the mare's reproductive status. I have the luxury of reading each mare's uterine biopsy sample myself which gives me an even more thorough understanding of the individual mare."

Specialists at the Hofmann Center also can provide state-of-the-art mare breeding management, including low-dose artificial insemination and intensive mare monitoring to ensure that breedings occur when the mare is at just the right stage of the cycle.

A recent case highlights the benefit of Penn Vet's team approach. A mare, unable to get pregnant for more than two years despite a variety of treatments, was referred to New Bolton Center as a last resort. She was found to have blocked oviducts, an uncommon condition. Using a minimally invasive laparoscopic technique, one of New Bolton Center's board-certified surgeons, Eric Parente, DVM, was able to gain access to the offending oviducts allowing Dr. Sertich to administer the specialized treatment that was needed to restore normal function to the oviducts. After the procedure the mare became pregnant following her next breeding.

The Newest Thing

In the 1980s embryo transfer was *the* cutting-edge assisted reproductive technology for mares, and the clinicians at Penn Vet led by Dr. Sertich, were instrumental both in developing the technique and introducing it into the horse breeding industry. Currently, embryo transfer remains the centerpiece of the assisted reproductive technologies offered, though newer, more advanced procedures such as oocyte transfer and intracytoplasmic sperm injection (ICSI) are being integrated into the expanding repertoire of assisted reproductive technology available.

As with embryo transfer in the 1980s, the clinicians at Penn Vet are at the forefront of the development and application of these new technologies. Oocyte transfer and ICSI are used in mares with pathological problems of the reproductive tract that prevent them from successfully donating embryos. Although these mares can't donate embryos, they can serve as oocyte (egg) donors, which involves collecting an oocyte directly from the mare's ovarian follicle. The oocyte must then be fertilized by transferring it to a recipient mare previously inseminated with the desired semen, or it can be fertilized in the laboratory using the ICSI procedure and then transferred to a recipient mare.

Stallions with poor semen quality can also benefit from these procedures, particularly ICSI, since it allows fertilization of an oocyte via microinjection of a single sperm cell. The ICSI procedure is also valuable when there is an extremely limited amount of irreplaceable frozen semen (e.g., stallion is deceased), since one "regular" breeding dose of frozen semen can be partitioned into potentially thousands of "ICSI" breeding doses. Collectively, these new technologies are ushering in a new era of high-tech horse breeding and the clinicians at Penn Vet are helping to lead the charge.

Pink...or Blue?

Once the breeding has taken place and a pregnancy confirmed, the gender of the fetus can be determined. For breeding managers, this is often an integral part of the business, influencing a variety of financial decisions. The process, which uses transrectal ultrasonography, is quick,

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causes the mare little stress and, for a clinician with extensive fetal sexing experience, such as Tamara Dobbie, DVM, is very accurate, as high as 98 percent when performed between 60 and 75 days of pregnancy.

As an example, during the 2011 breeding season three embryos from a single donor mare were transferred into three different New Bolton Center recipient mares and the resulting pregnancies were fetal sexed by Dr. Dobbie before the mares departed allowing Dr. Dobbie to inform the mare owner that, much to her delight, she could plan for the birth of two colts and one filly this spring.

Pregnancies at Risk, Foals in Danger

The majority of mares that are successfully bred will go through the 11 months of pregnancy without event. For the small percentage with a history of pregnancy loss in late gestation, or mares that have developed a serious medical condition that places the pregnancy at great risk, there is the high-risk pregnancy program. Housed in the Graham French Neonatal Section of the Connelly Intensive Care Unit (NICU), the mares are carefully evaluated to determine the status of the pregnancy and potential problems they face during gestation, delivery and early care of the foal. Mares are monitored daily by perinatologists and reproduction clinicians. Weekly transabdominal ultrasound exams and nightly fetal heart rate monitoring are performed to evaluate the well-being of the fetus. A team of veterinarians including perinatal-neonatal, reproductive, anesthesia and surgery specialists are on standby 24 hours a day to provide emergency care for delivery of the foal and to address any crisis situation the mare may encounter.

Once the foal is delivered the NICU is an integral part of the successful reproduction program. Stalls are designed for mare and foal comfort and safety, and the tools to provide sophisticated care including plasma transfer, parenteral nutrition delivery, ventilation and cardiovascular support are readily available.

"The specialists in this unit are experienced in fetal monitoring, birth and neonatal resuscitation and are experts in treating the large variety of diseases which may occur in the newborn secondary to a problem pregnancy," said Jonathan E. Palmer, VMD, director of perinatal/neonatal programs and chief of the Neonatal Intensive Care Service.

Conclusion

From stallion handling and behavior to breeding, mare management and delivery of a healthy, viable foal, the collective capabilities of the reproductive team, and the support of a full range of specialists allows New Bolton Center to provide an unparalleled level of expertise and service in equine reproduction.

Said Dr. Vanderwall, "It's essentially a comprehensive, start-to-finish approach to reproduction."