Introduction
Increasing consumer interest in how livestock are cared for and greater awareness among food animal producers and veterinarians has led to significant advancements in the area of food animal analgesia over the past several years.

Motivations for providing analgesia
There are primarily two motivations for providing analgesia to food animal patients. The first and probably most important reason is to improve the welfare of animals that are or are likely to experience pain from disease or injury or from procedures such as castration or dehorning. Consumers of animal products are becoming increasingly concerned about the welfare of animals raised for food and one of the primary areas of concern is pain caused by common management practices. One of the challenges to assessing increased welfare as a result of analgesia is the lack of an ideal way to measure pain in livestock species. Serum cortisol has been traditionally used as a marker of pain but cortisol can be influenced by a number of other factors. Serum haptoglobin, substance P, and other acute phase proteins are now being utilized as measures of pain in research studies. Behavioral assessments via recorded video are also becoming more common as a way to measure the impacts of analgesia on livestock welfare. Another motivation for providing analgesia to food animals is the effort to improve production or efficiency in animals that receive analgesia. Traditionally many studies failed to demonstrate a positive response to analgesia when production measures were used as the outcome. In many cases, measurement of changes in production is too insensitive to detect benefits provided by analgesia. Several more recent studies have been able to detect improvements in production or a decrease in disease risk when analgesia is provided. Demonstration of improved production or decreased disease risk may help encourage producers to utilize analgesia in food animal species.

Types of pain
A detailed discussion of the various types of pain and the mechanisms by which pain is perceived is beyond the scope of this discussion. However, it is important to remember that there are significant differences in managing acute versus chronic pain. Acute pain, such as pain caused by a surgical procedure, is much easier to control than chronic pain. This is especially true if preemptive measures to combat pain are utilized. Chronic pain often results in sensitization of peripheral and central pain receptors leading to conditions such as such as hyperalgesia and allodynia. In some cases, the patient still appears to be painful after the painful stimulus has been removed. Pain that has reached this state is much more difficult to control. The reader is referred to the documents listed below for more detailed description of the types of pain.
Expression of pain

It is important to remember that food animal species are inherently prey animals. This fact often has a tremendous effect on the expression of pain. Prey animals are very good at hiding pain in an effort to avoid being singled out by a predator. Fortunately, most of our livestock species don’t have to deal with large predators but those instincts often remain very strong. It is important to remember that animals may not look overtly painful but may still be experiencing significant pain. This can be a significant challenge to our ability to assess the need for, and response to, analgesic therapy.

Extra-label drug use

Currently in the US, there are no drugs labeled for preventing or treating pain in food animal species. Therefore, any use of a medication for the purposes of analgesia, constitutes extra-label drug use. In order for extra-label drug use to be legal, the requirements of AMDUCA must be met. Briefly, those requirements are:

- ELDU can only occur under the supervision of a veterinarian.
- Treatment records must be kept for at least two years.
- A valid VCPR is required.
- ELDU is legal only for therapeutic purposes.
- ELDU must not result in a violative residue or any residue that may be a threat to public health.

Commonly used analgesic drugs

The analgesic drugs commonly used in food animals fall into four categories. These categories are local anesthetics, non-steroidal anti-inflammatory drugs, opioids, and α adrenergic agonists. A more recent addition to the analgesic arsenal is gabapentin. Gabapentin is an analogue of gamma aminobutyric acid (GABA) and can be helpful in controlling central sensitization. In many cases, a combination or multimodal approach is most effective. Table 1 (next page) provides information regarding commonly used analgesic drugs for cattle. Table 2 (below) provides commonly used meloxicam doses for various food animal species.

Table 2. Meloxicam Doses for Various Food Animal Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Meat (days)</th>
<th>Milk (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>1 mg/kg (loading)</td>
<td>PO</td>
<td>Once</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td>Cattle</td>
<td>0.5 mg/kg</td>
<td>PO</td>
<td>q 48 hrs</td>
<td>up to 45</td>
<td></td>
</tr>
<tr>
<td>Camelids</td>
<td>1 mg/kg</td>
<td>PO</td>
<td>q 72 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>2 mg/kg (loading)</td>
<td>PO</td>
<td>Once</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>1 mg/kg</td>
<td>PO</td>
<td>q 24 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goats</td>
<td>0.5 mg/kg</td>
<td>PO</td>
<td>q 24 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine</td>
<td>0.5 mg/kg</td>
<td>PO</td>
<td>q 24 hrs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 1. Commonly Used Analgesic Drugs for Cattle

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose (mg/kg)</th>
<th>Route</th>
<th>Duration of effect</th>
<th>Meat (days)</th>
<th>Milk (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local anesthetics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine 2%</td>
<td>Max Dose 10 mg/kg Caudal Epidural 1ml/200 lbs</td>
<td></td>
<td>60-90 min</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bupivicaine</td>
<td>~4 hours</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>NSAIDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flunixin meglumine</td>
<td>1.1-2.2 mg/kg</td>
<td>IV</td>
<td>12 hours</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>Ketoprofen</td>
<td>3.3 mg/kg</td>
<td>IV</td>
<td>12-24 hours</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Meloxicam</td>
<td>1 mg/kg</td>
<td>PO</td>
<td>24-48 hours</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td><strong>Opioids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.05-0.2 mg/kg</td>
<td>IV, SQ</td>
<td>4-6 hours</td>
<td>4</td>
<td>72</td>
</tr>
<tr>
<td>Morphine</td>
<td>0.05-0.1 kg/kg</td>
<td>IV, SQ</td>
<td>4-6 hours</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>α adrenergic agonists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylazine</td>
<td>0.05-0.1 mg/kg 0.1-0.2 mg/kg</td>
<td>IV, IM</td>
<td>30 min</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>Detomidine</td>
<td>0.01-0.04 mg/kg</td>
<td>IV, IM</td>
<td>30 min</td>
<td>7</td>
<td>72</td>
</tr>
<tr>
<td>Tolazoline</td>
<td>1-2 mg/kg</td>
<td>IV, IM</td>
<td>Given to effect</td>
<td>8</td>
<td>48</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gabapentin</td>
<td>15mg/kg</td>
<td>PO</td>
<td>24 hours</td>
<td>21</td>
<td>???</td>
</tr>
</tbody>
</table>

**Resources**


The 2015 OSU/OVMA Summer was held June 12-13, 2015, with 193 veterinarians in attendance. Thank you to our speakers from Elanco, Exclusively Equine Veterinary Services, OSU Center for Veterinary Health Sciences, Oklahoma Link Coalition, and USDA APHIS.

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Laser Applications in Equine Surgery

Daniel J. Burba, DVM, DACVS

Introduction

Lasers for use in surgery have now been around for several years. The use of lasers in veterinary surgery continues to expand, although not as rapid as with other technologies. Lasers have allowed surgeons to reach into areas of an animal that are not possible through other approaches. The technology continues to “miniaturize” components, making it easier to bring lasers to the surgical field. Lasers are now even more affordable than previously. The development of new laser types and the development of fiberoptic and waveguide delivery systems have revolutionized the use of lasers in surgery. Some of the surgical techniques using the laser have been adapted from human surgery but specific techniques have also been developed specific for equine surgery. Improved endoscopic and endovascular procedures have allowed easier and safer use of lasers in specific surgical procedures such as the upper respiratory tract in the horse.

Before the various types of surgeries performed with a laser are discussed, it very important to understand how a laser unit works and interacts with tissue. Laser is an acronym for Light Amplification by the Stimulated Emission of Radiation. The laser has 3 basic components: Laser medium (which can be a gas, liquid or solid crystal), excitation source which energizes the medium, and a resonator. The resonator is a chamber containing 2 parallel mirrors, one totally reflective and the other partially reflective and allows some emission of photons. This concentrates and raises the energy level of the electrons in the medium when it is excited (Figure 1).

Laser activation occurs when energy is pumped into the lasing medium causing what is called a population inversion. The atoms within the medium become excited and start bouncing back and forth between the reflective mirrors. The atoms within the lasing medium spontaneously release photons. These photons will do one of two things: eventually pass through the partially reflective mirror in a parallel fashion (laser beam) or strike another atom causing further release of photons. The result is a tightly collimated coherent beam of light.

Laser power is measured in Joules. Joules is the amount of power (watts) per time (second) of activation. Also the amount of energy applied to tissue is referred to as the power density. This determines the type of biologic change that will occur in the tissue. Thus the more focused the laser beam, more the laser energy is concentrated on the tissue.

Figure 1. LASER light is generated via excitation of the laser medium that releases photons.

Laser Interaction

Lasers for the most part have a thermal effect on tissue. A laser beam can either cut, vaporize, coagulate, or even weld tissue. Various factors will dictate the reaction a laser has with tissue. These include power (wattage), laser spot size, duration of laser energy on an area of tissue, type of laser, as well as the type of tissue being lasered. A laser beam will react with tissue in one of four ways: it will be scattered, transmitted through it, reflected, or absorbed. Absorption of the laser light is the desired effect on the tissue. Depending on the type of laser it has been noted that denaturation of protein occurs between 60°C and 70°C, with vaporization occurring at 100°C. The smoke produced during cell vaporization is referred to as laser plume. Extreme caution should be taken to not inhale the plume as it could contain carcinogens or viable biological materials.

Laser energy can be delivered to the tissue via non-contact (free beam) or contact (laser fiber). With non-contact nothing comes in contact with the tissue except for the laser beam. Contact delivery is via a fiber which comes in contact with the tissue and delivers the laser energy directly onto the tissue. Most fiber-type lasers (diode) use quartz fibers (Figure 2).

Figure 2. Quartz laser fiber for contact lasering.
Lasers Commonly Used in Equine Surgery

The CO₂ and the diode laser are the most commonly used lasers in equine surgery. The CO₂ laser is a non-contact laser. It’s has a wavelength of 10,600 nm in the far infrared light spectrum range. Water absorbs CO₂ laser light so it will not transmit through a liquid. The other commonly used laser in equine surgery is the diode laser. The diode is a contact type laser and is transmitted through a quartz fiber. The diode laser light is absorbed by dark pigment and poorly by water. The diode laser has better coagulation and vessel sealing ability than the CO₂.

Surgeries Performed in Equine Surgery Using a Laser

**Palmar digital neurectomy**

Palmar digital neurectomy is performed as a palliative treatment for chronic heel pain and navicular syndrome. It has been shown that using a laser reduces the chances of painful neuroma formation which is a common occurrence. The CO₂ or the diode laser can be used, but my preference is the CO₂ laser (Figure 3). The horse is placed under general anesthesia and placed in dorsal recumbency. The limbs are positioned forward to allow easy access to the nerves. The palmar region of the limb is clipped of hair and aseptically prepared for surgery. The area is surgically draped and a two-incision technique is used to remove as much nerve as possible. Each incision is approximately 1.5 cm in length along the abaxial edges of the deep flexor tendon in the palmar region. Once the nerves are elevated a gauze sponge dampened with saline is placed under the nerve to serve as a back stop for the laser beam. The nerve is transected distally first, with the laser set at 10 watts of energy. The nerve is pulled through the proximal incision placing a hemostat underneath it and elevating. The nerve is grasped, placed under tension and then transected with the laser beam. The purpose for use of the laser is to seal the nerve end to prevent axonoplasma from escaping, which would lead to neuroma formation.

**Sinus cyst and Ethmoid hematoma extirpation or ablation**

Fluid filled cysts and ethmoid hematomas form in the frontomaxillary sinus of horses. Sinus cysts form as a result of a closed secretory lining of the sinus cavity filling with mucinous type fluid. This cyst can result in facial bone remodeling, swelling and decreased nasal passage. An ethmoid hematoma is a benign expansile tumor originating from the ethmoid turbinates. This tumor like structure will also cause facial bone distortion, swelling and obstruction of the nasal passage. The diode laser with its excellent hemostatic properties is used to transect vessels during extirpation of the mass through a sinusotomy flap. Small ethmoid hematomas invading the nasal passage can be ablated via endoscopic visualization with the endoscope passed up the nasal passage and with the diode fiber passed through the biopsy chamber of the endoscope. This can be performed in a standing sedated animal.

**Modified Forssell’s for treatment of cribbing**

Cribbing is a stereotypic behavior unique to horses. A surgical technique called the modified Forssell’s has been devised to alleviate cribbing in horses. The surgery entails a 35 cm skin incision ventral surface of the neck. The skin incision is started approximately 1 cm rostral to the hyoid apparatus and extends caudally. Once the muscles of the ventral cervical region is dissected from its fascia, the paired omohyoideus and sternohyoideus mm are transected from their attachment on the hyoid using either a CO₂ or diode laser. The sternothyroideus mm are transected from their attachment on to the thyroid cartilage. The muscles are elevated off the trachea and transected approximately 34 cm distally (Figure 4). The CO₂ laser is set at approximately 15 watts or 25 watts if a diode laser was used.

Figure 3. CO₂ laser being used to perform a palmar digital neurectomy.

Figure 4. Anatomy of the ventral cervical region of the horse showing where the muscle transections occur using a laser for a modified Forssell’s procedure to alleviate cribbing.
Endometrial cysts
Endometrial cysts (uterine cysts) are a contributing factor to subfertility in the mare. Uterine cysts are fluid-filled structures that can occur anywhere in the normal or chronically inflamed endometrium. Cysts are characterized as either glandular or lymphatic. These can be ablated by the use of a diode laser. The best laser for use in uterine cyst ablation is the Nd:YAG applied in a non-contact mode. However, Nd:YAG have kind of gone along the wayside and replaced with diode lasers. A flexible endoscopy is passed through the cervix into the uterus. The uterus is then distended with room air. Once a cyst is visualized, the laser fiber is passed down the biopsy channel of the endoscope and placed in contact with the wall of the cyst. Low energy (15 watts) is used to blanch and shrink the wall of the cyst. If it is a large cyst, the wall is then ruptured with the laser to allow escapage of the fluid. Mares with uterine cysts will often have multiple cysts. Most mares will require sedation as the insufflation of the uterus with air will make the mare uncomfortable.

Tumor ablation
Lasers are commonly used to ablate or debulk skin tumors such as sarcoïds and squamous cell carcinomas. CO₂ laser works best, as being free beam, it can be painted over the surface of the tumor or tumor bed (Figure 5). It is usually best to debulk the tumor first with a scalpel, then “lasing” the tumor bed. Several hundred joules of energy is often needed to complete the task. The bed of the tumor is lasered until enough tissue has been removed below the level of the skin. Repeat treatment every 2-3 weeks may be necessary.

Figure 5. A CO₂ laser being used to ablate a sarcoïd on neck of a horse.

Facilitated ankyloses of low motion joints
Low motion joints such as the proximal interphalangeal (high ring bone) and distal intertarsal and tarsometatarsal (bone spavin) develop osteoarthritis resulting in lameness. The method of choice for treatment of advanced cases is facilitated ankylosis. The laser of choice is the diode laser. Various techniques have been developed for using the laser; however, my method of choice is to drill 2 mm holes into the joint and then pass a 16 gauge needle into the drill hole followed by the laser fiber. A 600 µm fiber is used. Approximately 2000 joules of laser energy is applied. Additional needles are placed into the joints to egress the boiling synovial fluid and plume. The needles become hot enough to cause thermal damage to skin at the entry site. Thus the entry portals are bathed with sterile iced saline during lasing.

Laryngeal ventriculectomy
Laryngeal ventriculectomy is performed to alleviate upper respiratory track noise and reduce airway resistance during exercise. It is often done in conjunction with a prosthetic laryngoplasty. My preference is to perform it via endoscopic visualization. The horse is sedated and the larynx is sprayed with approximately 20 ml of carbocaine through the biopsy channel of the endoscope. Through the opposite nasal passage, bronchoesophageal forceps are passed and the ventricle is grasped and everted. A 600 µm fiber of a diode laser is passed through the biopsy channel of the endoscope and by contact, the sac of the ventricle is transected via manipulation of the laser fiber with the endoscope movement (Figure 6).

Figure 6. Laser ventriculectomy being performed with a diode laser in larynx of a horse.

Palatoplasty
Dorsal displacement of the soft palate is a common disorder in racing horses. Various procedures have been developed to prevent displacement of the soft palate. It was proposed several years ago that by increasing the rigidity of the soft palate, would make it more difficult for the soft palate to displace beneath the epiglottis, thus reducing the incidence of displacement.

(continued)
The laser palatoplasty procedure is performed via endoscopic guidance using a diode laser. The horse is sedated and the palate is sprayed with 20 ml of carbocaine. The soft palate is displaced and a 600 µm fiber is passed through the biopsy port of the endoscopy and the laser is set at 20 watts of power. Short bursts of 2 seconds of the laser is applied in multiple spots to the entire caudal region of the soft palate. Essentially the laser is applied in a “pin-fire” technique (Figure 7). It is important the epiglottis maintain displacement during the procedure. Repeated sedation may be required to accomplish this.

Figure 7. Laser palatoplasty being performed with a diode laser in the larynx of a horse.

**Aryepiglottic fold transection**

Entrapment of the epiglottis by the aryepiglottic fold (epiglottic entrapment) occurs in speed event horses resulting in reduced exercise tolerance. It is thought to be due to inflammation. The procedure is performed via endoscopic visualization using a diode laser. The horse is sedated and the aryepiglottic tissue is sprayed with 20 ml of carbocaine. A 600 µm fiber is passed through the biopsy port of the endoscope and the laser is set at 20 watts of power. Bronchoesophageal forceps can be passed through the opposite nasal passage and used to grasp the aryepiglottic fold and lift it off the epiglottis. The aryepiglottic fold is transected axially in caudal to rostral manner via endoscopic controls (Figure 8). Once transected, the fold will fall underneath the epiglottis. In some cases the aryepiglottic fold will not fall “off” due to the increased thickness of the tissue. Local and systemic anti-inflammatories are used to reduce swelling of the tissue.

Figure 8. Laser transection of the aryepiglottic fold.

**Subepiglottic cyst resection**

Subepiglottic cyst can occur in any age horse but is generally recognized in young horses in training. Subepiglottic cysts can result in upper airway noise, dysphagia, and poor performance. The exact etiology is unclear. The procedure is performed via endoscopic visualization using a diode laser. The horse is sedated and the laryngeal region is sprayed with 20 ml of carbocaine. A 600 µm fiber is passed through the biopsy port and the laser is set at 20 watts of power. Bronchoesophageal forceps passed through the opposite nasal passage are used to grasp the cyst. This can be a difficult task as they often lie under the soft palate. Once the wall of the cyst is grasped a large window is cut into the cyst. Care is taken not to touch the epiglottis with the activated laser fiber as this will cause thermal trauma to it and result in adhesion formation.

**Transection of the wall of the guttural pouch**

Guttural pouch tympany is a rare condition that can occur in foals. It is caused by the pharyngeal opening(s) of the guttural pouch(es) acting as a one way valve, trapping air in the guttural pouch(es). This results in an outward distention of the guttural pouch(es). Treatment consists of creating a window in the medial wall of guttural pouches thus allowing air to escape through the normally functioning pouch. The procedure can be performed on a standing sedated foal. Generally local anesthesia is not needed. A 600 µm fiber is passed through the biopsy port and the laser is set at 20 watts of power. Laser division of the median septum is accomplished by driving the endoscope axially immediately after entering the guttural pouch. A large hole is created as it will shrink in size with healing. In a rare situation, both guttural pouches may be affected. If that is the case, the tissue over the pharyngeal openings of the guttural pouches is removed with the laser.
References


Oklahoma State University
Veterinary Research Scholars Program

The Summer Research Training Program at Oklahoma State University is designed to identify talented and highly motivated veterinary students interested in exploring a career in veterinary research and then provide those students with an outstanding biomedical research summer training experience. **The overarching objective of this program is to persuade outstanding veterinary students to pursue biomedical research careers.** The program is structured to achieve this objective both explicitly, through formal training in the process involved in becoming a research scientist, and implicitly, by providing professional support and encouragement through informal interactions with successful veterinary research scientists who are excited about the personal and professional satisfaction gained from their careers. This program is supported by Faculty Directors Dr. Jerry Malayer, Dr. Chris Ross and Dr. Ashish Ranjan. Funding support for these research projects included the National Institutes of Health and the Merial Veterinary Scholars Program, Merial Ltd., Morris Animal Foundation, Oklahoma State University and the Oklahoma Medical Research Foundation. Select abstracts can be found on the pages that follow.

Veterinary students and their advisors included:

Kaitlyn Belanger……Dr. Brenda Smith
Peter Czajkowski….Dr. Ashish Ranjan
Emily Davis…..Dr. Jennifer Grindstaff
John Evans………………Dr. Susan Little
Victoria Hanna……….Dr. Ashish Ranjan
Alia Houser…..Dr. Véronique Lacombe
Livvy Jones………………Dr. Susan Little
Lauren Kuzimski……Dr. Sarah DuRant
Chris Maffry….Dr. Véronique Lacombe
Melissa Nelson………..Dr. Jared Taylor
Jose Oyola Morales……Dr. Susan Little
& Dr. Todd Holbrook
Molecular prevalence and diversity of *Dirofilaria immitis* in canine blood samples

John Evans, Susan Little, Jeff Gruntmeir
Oklahoma State University CVM, Stillwater, OK

Antigen detection of heartworm (*Dirofilaria immitis*) has supplanted microscopy as the preferred approach for diagnosis. However, dogs with microfilaria in circulation may test negative for heartworm on commercial antigen tests, and, because microfilaria of different canine filarids are similar in appearance, definitive diagnosis of *D. immitis* by microscopy alone can be difficult. Additionally, contemporary estimates of the likelihood of discordant results are needed in order to make evidence-based recommendations to veterinarians about best diagnostic practices for heartworm. Molecular identification of microfilariae present in blood samples allows definitive diagnosis of *D. immitis* infection and provides an accurate, sensitive estimate of the prevalence of this stage in canine blood samples. Therefore, we used a PCR protocol designed to amplify the 5.8S-ITS2-28S region of a number of different filarids to identify prevalence of atypical filarids in the region and species potentially responsible for discordant antigen binding results. Identification of filarid DNA in PCR products was complicated by the presence of mixed sequences in several samples necessitating cloning. Sequencing results from two samples that were negative on antigen test before and after heat treatment revealed one to have *D. immitis* and the other to have *Acanthocheilonema reconditum*. We plan to continue cloning samples after PCR amplification to identify both the species and any genetic variation present.

Diversity of the brown dog tick, *Rhipicephalus sanguineus*, in North America

Livvy Jones, Jeff Gruntmeir, Susan Little.
Department of Pathobiology, Oklahoma State University, Center for Veterinary Health Sciences, Stillwater, OK.

The brown dog tick, *Rhipicephalus sanguineus*, has a worldwide distribution due to the ubiquity of its primary host, the domestic dog. However, different populations of *R. sanguineus* vary in their behavior and ability to transmit different disease agents. Recent review of morphology and mitochondrial gene sequences of brown dog ticks collected from Europe, Asia, South America, and Oceania has shown that the *R. sanguineus* complex parasitizing dogs is actually comprised of several distinct taxonomic units commonly referred to as *R. sanguineus* sensu lato, *R*. sp. I, *R*. sp. II, and *R*. sp. III. To determine the genetic diversity of *R. sanguineus* in the United States and the Caribbean, we examined ticks collected from several geographic locations (n=20), including Oklahoma, Texas, Illinois, Florida, Arizona, California, and Haiti. All ticks were identified as brown dog ticks by morphologic examination and comparison to standard keys. Ticks were also dissected and mitochondrial genes amplified and sequenced. To date, sequence analysis has confirmed the presence of both *Rhipicephalus* sp. II (southern lineage) and *R. sanguineus* sensu lato (northern lineage), suggesting multiple morphotypes are present in the region. Analysis of additional brown dog tick specimens from North America will allow more complete understanding of the full extent of diversity in the *R. sanguineus* complex and likely has important implications for disease transmission, including zoonotic risk.
Molecular Epidemiology of the skin flora of dogs undergoing an elective surgical procedure

Melissa Nelson, Dr. Jared Taylor
Oklahoma State University CVHS, Stillwater, OK

Surgical site infections cause delayed patient healing, risk for post-operative complications, and increased costs for the owner. Hospitalized patients are at increased risk for acquiring a resistant infection. This study investigates changes in bacterial flora of dogs throughout preparation and recovery from a surgical procedure, and the genetic similarity of the organisms isolated. Seven client-owned dogs presented for elective surgery were chosen for sampling. All patients remained hospitalized at least 36 hours after admission. Nasal and perianal samples were taken upon admission and prior to discharge. In addition, samples were taken from the skin adjacent to the surgery site before initial site preparation, after preparation with Chlorhexidine Digluconate scrub, after preparation with Iodine Povacrylex/Isopropyl alcohol (DuraPrep™), and before discharge. Isolates were identified by colony morphology, gram stain, and MALDI. Environmental samples were also taken from in the hospital. Bacteria isolated included many Staphylococcus species, many Bacillus species, Proteus mirabilis, Pseudomonas aeruginosa, and Enterococcus species. Bacteria isolated that are known sources of surgical site infection were cryo-preserved in glycerol for further analysis. Bacteria were isolated from the skin after preparation with Chlorhexidine scrub, but none were isolated after preparation with DuraPrep™. An increase in the number of bacterial isolates obtained from time of admission to time of discharge was noted. Results of Pulse Field Gel Electrophoresis of the Staphylococcus isolates are pending. Further analysis will include antimicrobial sensitivity testing. PCR will confirm the presence of resistance genes, if necessary.

Research Grant: Oklahoma State University Center for Veterinary Health Sciences
Student Support: Morris Animal Foundation

Culturing of Equine Herpesvirus 5 to Test the Inhibitory Properties of Various Drugs on Viral Replication.

Oklahoma State University College of Veterinary Medicine, Stillwater, OK.

Equine Multinodular Pulmonary Fibrosis (EMPF) is a newly characterized interstitial lung disease of horses recently linked to equine herpesvirus 5 (EHV-5). Although there has been a lot of progress in characterizing various aspects of EHV-5, and its role in the onset of EMPF, in vitro studies to determine the effects of antiviral-drugs on EHV-5 are absent in the literature. Utilizing various cell lines such as rabbit kidney, Madin-Darby bovine kidney, and primary equine lung cells we designed a protocol for culturing EHV-5. Additionally, we refined an RT-PCR protocol to quantify viral DNA in infected cells, in order to begin testing the inhibitory properties of various drugs on viral replication in vitro.

Research grant: Oklahoma State University
Student Support: Oklahoma Center for Veterinary Health Science, National Institute of Health, and Merial Ltd.
Unidentified nematode morphologically distinct from *Trichinella* spp. detected in feral hog

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Feral hogs (*Sus scrofa*) have been increasing in population and locations across the United States. With this change come the increases in human and domestic animal interactions with wild swine. Feral hogs are known to carry up to 30 infectious agents, 20 of which are zoonotic, including *Trichinella* spp. Previous studies have shown a seroprevalence of 14% (6 of 42) to *Trichinella* spp. antibodies in feral hogs from Oklahoma. Our purpose was to determine the prevalence of *Trichinella* spp. first-stage larvae in feral hogs and to genotype the worms. Tongues from 42 feral hogs collected from counties in Oklahoma were examined using pepsin-HCl artificial tissue digestion. Artificial digestion showed a prevalence of 0% for *Trichinella* spp. However, the prevalence of an unknown nematode (91.3% of 241 worms) was freeze-resistant, similar to *Trichinella* spp. However, the prevalence of an unknown nematode, morphologically distinct from *Trichinella* spp., was 85.7% (36 of 42). The mean intensity of the unknown nematode larvae ranged from 0.2 to 4.2 larvae per gram (LPG) of tissue. The mean intensity of the unknown nematode larvae was 1.2 LPG. The mean size of the feral hogs was 1.5 to 2.5 months old. Of the 42 feral hogs, 9.5% (4 of 42) were alive, showing freeze-resistant characteristics after being frozen at -20 C for 1.5 to 2 months. Future research will focus on determining the identification of this unknown nematode.