

HorseReport

FALL 2024



Equine Cancer

THANK YOU TO OUR COLLABORATOR



Dr. Berryhill earned her DVM at UC Davis, where she also completed a large animal internal medicine residency. She is board certified by the American College of Veterinary Internal Medicine and is currently an assistant professor in the UC Davis School of Veterinary Medicine. Dr. Berryhill's research focuses on equine oncology and endocrinology.

DIRECTOR'S LETTER

Cancer is a health risk for horses, as it is for most animals. The good news is that many equine cancers are treatable, especially when diagnosed in early stages. From chemotherapy to surgery, the UC Davis veterinary hospital is equipped with advanced diagnostics and therapeutic capabilities to tackle tumors in horses.

Although there are many types of cancers, in horses the majority are associated with the skin. In this issue, we focus on the three most reported equine cancers – sarcoids, squamous cell carcinoma, and melanoma. We are especially grateful to Dr. Emily Berryhill of the UC Davis Equine Internal Medicine Service for sharing her expertise on diagnosing and treating these types of tumors. We would also like to thank Dr. Lauren Charnock of the Ophthalmology Service and Dr. Rebecca Bellone, director of the UC Davis Veterinary Genetics Laboratory, for providing added insights into cancer of the equine eye and genetic factors associated with equine cancers.

As with other health conditions in horses, early cancer diagnosis is essential to successful outcomes. We hope this issue provides you with tools to identify when lumps and bumps require a closer look and how to communicate effectively with your veterinarian.

As we say goodbye to another year, we want to thank you for your continued support of the Center for Equine Health. We have exciting plans for 2025 and look forward to continued partnerships in the new year!

Have a wonderful holiday season,

Carrie J. Finno, DVM, Ph.D.,
Diplomate ACVIM
CEH Director



EQUINE CANCER

Treatments at UC Davis

Cancer can be treated in many ways.

At UC Davis, we offer traditional treatments, as well as innovative approaches and clinical trials. Our clinicians and veterinary teams, including internal medicine specialists, oncologists, surgeons, pathologists, and other experts across a variety of departments, work closely with clients to determine individualized treatment plans with a focus on optimal quality of life and successful outcomes for each patient.

Individualized therapeutic plans may include:

Surgery - Surgical excision may be required for biopsies or tumor removal, depending on the size and location of the mass.

Chemotherapy - Systemic chemotherapy, in which drugs are administered intravenously, used to be very rare in horses due to the cost of the medications, but it is now available at some clinics, including UC Davis. Local chemotherapy, in which the chemotherapeutic drugs are injected at the tumor site, is frequently used for specific tumors.

Immunotherapy - Drugs that use substances to activate or suppress the immune system to treat cancer are available for ocular tumors.

Radiation therapy - Some tumors are very sensitive to radiation, but the location of the tumor may affect the feasibility of this treatment method.

Treatments may be used in combinations to achieve optimal outcomes in individual cases.



Recognizing Signs of Cancer in Horses

Early diagnosis is important to cancer treatment. Daily grooming is a good time to check horses for new lumps and bumps or changes to existing masses. Other signs of cancer in horses may include:

- Reduced appetite
- Weight loss
- Diarrhea
- Lethargy
- Swollen lymph nodes
- Changes to the hair coat
- Hair loss

The prognosis for horses diagnosed with cancer varies based on the type, location, and stage of the tumor, but many can be successfully managed.

**Contact the UC Davis Large Animal Clinic at (530) 752-0290
for more information or to make an appointment.**

SQUAMOUS CELL CARCINOMA

Squamous cell carcinoma (SCC) is the second most diagnosed tumor in horses. It can develop anywhere, but is usually identified in non-pigmented, or lightly pigmented, areas of the head and neck, eyes, and genitals.

Squamous cells are flat, thin cells that resemble fish scales. They have important roles in absorption, protection, and transportation of substances and are found in skin and mucous membranes. This includes the linings of organs such as the stomach, kidneys, and lungs.

Locally invasive and usually slow to spread, SCC may appear as open, scaly, or crusted areas and can progress to non-healing wounds and large tumors. Spread to other parts of the body, or metastasis, is common, especially to lymph nodes. Tumors in the gastrointestinal tract and on the penis are often highly malignant. Although it can affect horses of any age, SCC is most often reported in horses older than 10 years of age.

Chronic exposure to ultraviolet (UV) light is a well-known risk factor and accounts for the predisposition to SCC formation in non-pigmented skin that is regularly exposed to the sun. Another risk factor for SCC is chronic inflammation or irritation, such as a chronic wound. In recent years, researchers have established a link between equine papillomavirus-2 (EPV-2) and genital SCC lesions. There are also genetic links to the development of some SCC.

As with other types of cancer in horses, treatment for SCC usually consists of surgical excision with wide margins around the affected area. However, this is not always possible depending



SCC in non-pigmented skin around the eyes. Photo courtesy of Dr. Emily Berryhill.

on the location of the tumor, and recurrence rates can be high even following apparently successful surgery. Alternative primary or supportive secondary treatment can include radiation therapy, chemotherapy, or photodynamic therapy.

Ocular Squamous Cell Carcinoma

Ocular SCC is the most common cancer of the equine eye. The tumor arises in the outermost layer of skin of the eyelids, conjunctival, or corneal cells. Tumors may grow rapidly and can spread to invade adjacent tissues, causing visual impairment and destruction of the eye.

Early detection of tumors is correlated with the most successful outcomes. Unfortunately, many tumors are large by the time they are noticed, especially if they are located on the third eyelid, which can be difficult to see. The longer the tumor is present, the more likely it will invade surrounding tissues, and the more difficult it becomes to treat.

Researchers at UC Davis, with support from the UC Davis Center for Equine Health (CEH), discovered a variant in the *damage-specific DNA binding protein 2 (DDB2)* gene and determined that it is a causal risk factor for ocular SCC in several breeds, including Haflingers, Belgians, and Rocky Mountain Horses. The function of this gene is to repair DNA damaged by UV light. Horses with two copies of the recessive variant (homozygous) are at increased risk of



Horses at risk for ocular SCC should wear UV-protective fly masks during sunlight hours.

developing ocular SCC compared to horses with only one copy (heterozygous) or no copies of the variant. This variant does not explain all cases of ocular SCC, but it appears to be a major contributor in the identified breeds.

Owners can use the DNA test available through the UC Davis Veterinary Genetics Laboratory to identify horses at higher risk for ocular SCC, take precautions to protect them, and selecting mating pairs to breed horses that are at lower risk.

Horses homozygous for the variant should have routine eye exams so tumors are caught early. Additionally, high-risk horses should wear UV-protective fly masks and be stabled during peak sunlight hours. Breeding homozygotes and heterozygotes among or to each other should be avoided to reduce the chances of producing horses that have a high risk of developing SCC. The ideal mate in either case is a horse with no copies of the risk factor (N/N).

Treating Ocular SCC in CEH Teaching Herd Horse O'Linda

A routine eye examination identified abnormal tissue in the right eye of CEH's 25-year-old Thoroughbred mare O'Linda. The tissue was removed by UC Davis veterinary ophthalmologists and a sample was sent to a laboratory for histological analysis. The surgery site was treated with photodynamic therapy. The diagnosis was confirmed as SCC. The surgery was successful, with clean margins, and O'Linda recovered well. UV light likely played a role in tumor development in this case. Testing at the UC Davis Veterinary Genetics Laboratory indicated that O'Linda does not have any copies of the SCC genetic variant. Recurrence is unlikely, but we make sure that she is not exposed to excessive UV light that could lead to new tumor formation.



CEH Teaching Herd Horse O'Linda



O'Linda was diagnosed with ocular SCC (pink area) in her right eye.



UC Davis veterinary ophthalmologists successfully removed the tumor from O'Linda's eye. It has since healed, and the site has pigmented.



CEDAR'S YEAR-LONG SARCOID SAGA

Dr. Erin Lane was surprised when her normally easy-going warmblood gelding, Cedar, uncharacteristically took off bucking during a ride. A few days later, her instructor noticed a lesion on his inner thigh. Thus began a year-long saga, and extended stay at UC Davis, to rid Cedar of sarcoids.

Lane, a life-long equestrian and owner of Occidental Veterinary Hospital in Sonoma County, bought Cedar in 2020 during the COVID-19 lockdown. She found that the former Grand Prix jumper quickly took to dressage as a second career. Cedar and Lane had only been partners for a year when the sarcoids were discovered.

Sarcoids are commonly diagnosed skin tumors. They are generally not life-threatening. However, they can become aggressive locally, causing irritation and discomfort and limiting performance if they are in high motion areas or in contact with tack.

In Cedar's case, the sarcoid on the inside of one hind leg rubbed against the inside of the opposite leg, inoculating it with tumor cells. He ended up with adjacent tumors that continued to irritate each other and further spread the sarcoid cells. The repetitive trauma also made it harder for the sites to heal.

"Sarcoids are notorious for having microscopic tumor cells that extend far beyond the edge of what we can see," said Dr. Emily Berryhill, a UC Davis equine internal medicine specialist who was part of the team that managed Cedar's case. "This means that we must treat a wide area. Cedar ended up having large areas to treat that were hard to access."

Treatment involved a combination of surgery, chemotherapy, and radiation therapy. Initially, the mass on the right thigh was removed surgically. Both the left and right-side lesions subsequently underwent rounds of

chemotherapy and radiation treatments.

"Even though Cedar was a model patient, the location of the sarcoids required general anesthesia for accessibility," said Berryhill. "His case is an example of using an aggressive, multimodal approach that we are privileged to be able to provide at UC Davis."

Cedar experienced some local recurrence of the sarcoids, which was addressed with laser surgery and additional chemotherapy. He resided at the Center for Equine Health (CEH) for the duration of his treatments – nearly 13 months.

"He is a very sweet, kind horse," said Lane. "He is so much fun to ride, but I really just wanted to save his life – whether he ended up being rideable or not."

Cedar has been back at home with Lane for a year. They have been to a show and clinics and have been practicing some upper-level movements. She checks the former sarcoid sites periodically. He has some scar tissue, but no new lumps.

"His attitude is great," reported Lane. "It is just taking a long time. We kept going with procedures because he recovered so well and was so easy to handle. He is a unicorn."

The staff and students at CEH and the veterinary hospital agree with that mythological comparison. We love to get updates on our beloved former patient who beat the odds thanks to a dedicated owner, advanced treatment options, skilled clinicians, and the healing power of time.

Cedar
undergoing
radiation
treatment for
sarcoids on his
inner thighs.



Cedar and Dr.
Lane are back in
the show ring.



Healing lesion on the left inner
thigh after treatment.



Healed lesions (pink areas) on
the left and right inner thighs.

How to Determine the Right Sarcoid Treatment

- Take a thorough history - how long the mass has been there, if it is changing (and how fast), and what treatments have been done. By the time cases are seen at UC Davis, some treatments have usually been attempted.
- Determine the location, size, and depth of the mass. Small and superficial sarcoids may be treated with topical therapies at home with the help of a veterinarian. Larger or more extensive tumors may be removed surgically, eliminating the need for further treatment provided there is enough extra skin in the area to close the incision.
- Many sarcoids are in locations where a wide surgical excision is not possible, such as around the eye, on the ear, or inside of the hind leg. In these cases, smaller surgical margins are taken to ensure that there is enough skin to close the surgery site. Follow up treatment may include chemotherapy or radiation therapy.
- For large areas or if the mass continues to regrow, external beam radiation therapy, a specialty procedure available at UC Davis, may be considered. The horse is anesthetized and positioned very specifically under the radiation beam, so there are specific requirements related to the treatment area for this to be an option.
- The main goals of treatment are to manage the tumor while minimizing damage to surrounding tissues. This can be challenging as there are pros and cons to each treatment.

EQUINE MELANOMA

The Gray Areas

Owners of gray horses should pay attention to lumps and bumps on their horses' skin, especially as their horses get older. They are primarily on the lookout for melanomas, skin tumors common in gray horses.

Melanoma is a cancer of melanocytes, specialized skin cells that produce pigments for skin and hair color (among other things). Melanomas appear as small, black, dome-shaped bumps. They often occur under the tail, in anal and genital regions, on lips and eyelids, and under the throatlatch. Tumor location can affect a horse's quality of life, especially as they get larger over time. Horses can also develop internal melanomas, which are usually life-threatening.

Melanomas are generally slow-growing tumors. They are usually initially benign but can become malignant and metastasize to other locations in the body.

Genetics and the Graying Process

A supply of stem cells makes new melanocytes as hair grows and sheds. Gray horses possess one of two genetic copy number variants that supercharges this process and prematurely exhausts the stem cell supply. The hair

essentially runs out of color and has no way to make more. This explains why these horses are born with pigmented coats that turn gray over time. Unfortunately, supercharging the process can predispose horses to develop malignant cells that lead to melanoma.

Speed of Graying and Melanoma Incidence

Gray is an autosomal dominant trait, meaning that a horse needs one version of the genetic variant to be gray, regardless of the variants it has for other color genes (chestnut, bay, black)*. UC Davis researchers at the Veterinary Genetics Laboratory (VGL) participated in a recent study that showed gray is caused by differences in the number of copies of the genetic variant. Some gray horses result from two copies (G2 allele) while others have a version with three copies (G3 allele) (Rubin, 2024).

Breeds such as Connemara ponies show pronounced variation in the speed of graying. Fast graying horses are white by 10 years of age, whereas slow graying horses stay dappled. Fast graying horses (those with the G3 allele) have a

higher incidence of melanoma than slow graying horses (those with the G2 allele).

Research has shown that speed of graying and melanoma incidence comes down to the number of copies of the gray genetic variant. Up to six copies have been identified in fast-graying individuals, with up to nine copies present locally in the melanomas themselves.

Gray horses lose pigment at different rates as they age. Fast-graying horses are at higher risk for developing melanomas.



Melanomas in Non-Gray Horses

Although melanomas are observed at a higher frequency in gray horses, non-gray horses can be affected. Melanomas in solid-colored horses are more severe, often metastasizing to lymph nodes or organs, making them difficult to treat and leading to a poor prognosis. The genetic risk behind melanomas in non-gray horses is not well understood.

Melanoma Treatment

The first choice for melanoma treatment is surgical excision with wide margins. Tumor regrowth at the same site is unlikely in cases with clean surgical margins. However, surgery at one site does not reduce tumor development at other sites and it may not be an option in advanced cases. Local chemotherapy may be used for small tumors, but melanomas are generally resistant to systemic chemotherapy. Radiation therapy may be used to treat melanomas in some locations, like the throatlatch region.

Melanoma Vaccines

Melanoma vaccination strategies have been explored, but data interpretation has been challenging due to a lack of control groups and reports of wide-ranging data.

The ONCEPT™ canine melanoma vaccine, licensed for oral melanoma treatment in dogs, can be obtained for off-label use in horses by veterinary oncologists. A small study in unaffected horses demonstrated that the vaccine is safe and generates an immune response but did not test for a clinical response (Lembcke et al. 2012). A clinical trial that used the vaccine to treat 50 horses with melanomas reported tumor shrinkage in most horses (Phillips et al. 2012). More studies are needed to evaluate the effectiveness of melanoma vaccines in horses.

More Research is Needed

There is no clear consensus on the best ways to treat melanomas. Even if they are successfully removed, new melanomas develop, especially as horses age. Further research is needed to better understand tumor development and progression and how best to treat the disease.

It is important to note that although melanomas are common in gray horses, and in severe cases euthanasia may be necessary, there is no evidence that gray horses have shorter lifespans than non-gray horses.

*The VGL offers genetic testing for gray and a variety of other equine coat colors. The gray test now reports copy number and the G2 and G3 alleles when it is resolvable. The non-gray allele is reported as N. Testing requires 20-30 pulled hairs and results are available in approximately two weeks.



Melanomas on a gray horse that extend below the left ear, indicated by a red arrow. Photo courtesy of Dr. Emily Berryhill.



A gray horse with multiple melanomas under the tail. Photo courtesy of Dr. Emily Berryhill.

10 THINGS

You Might Not Know About Equine Cancer

Equine cancer is discussed less than cancer in dogs, cats, and people. However, increased longevity in horses and advanced diagnostics and treatments have stimulated more conversations. We worked with Dr. Emily Berryhill of the UC Davis veterinary hospital's Equine Internal Medicine Service to bring you the latest on equine oncology.

1 **Horses may have a lower predisposition for cancer than other species.**

Tumor incidence is lower in horses compared to other long-lived species. It is unknown if this represents true resistance or if it takes longer for cancer to develop in horses and is more difficult to detect due to their large body size. Since horses are more likely to die from causes such as colic, laminitis, or catastrophic injuries, the true incidence of cancer in horses is undetermined.



Horses may be less likely to get cancer than other species.

2 Bovine papillomaviruses (BPVs) are linked to equine sarcoids. Cattle have a natural immune response to BPVs that leads to regression of warts, but immune response is likely impaired in sarcoid-affected horses. Studies have identified BPVs in over 70% of sarcoid cases.

3 Some horses are prone to sarcoids, but the reason is unclear. Environmental and genetic factors affect sarcoid development. Research has shown increased sarcoid prevalence in families and across breeds. Associations between sarcoid occurrence and variants in the major histocompatibility complex, a set of genes essential to the immune system, have been identified. Data suggests that sarcoid susceptibility is likely influenced by multiple genes rather than a single gene.

4 A genetic test can identify horses at risk for ocular squamous cell carcinoma (SCC). Squamous cell carcinoma is the most diagnosed tumor of the horse's eye. SCC risk factors include UV exposure, pigmentation, and genetics. A variant in the *damage-specific DNA binding protein 2 (DDB2)* gene, discovered at the UC Davis Veterinary Genetics Laboratory with funding from CEH, results in increased risk in Haflingers, Belgians, Rocky Mountain Horses, Connemara Ponies and crosses. Horses with two copies of the variant (homozygous) should undergo routine examinations for early detection and better prognosis and wear a UV protective fly mask.

5 Up to 80% of gray horses have at least one melanoma by age 15.

Melanomas are common in older gray horses. In a classification system from grades 1 to 5, with 5 being the most severe, melanomas are expected to increase by 0.3 grades each year. Gray is caused by a copy number variation in the *syntaxin 17* gene and horses with three copies (G3) show faster graying and high incidence of melanoma.

6 Melanomas in non-gray horses are usually aggressive and malignant.

Melanomas are associated with gray horses. However, non-grays, such as bays and chestnuts, can develop melanomas, and they are likely to be malignant and metastasize early.

7 Mares with extreme behavioral changes RARELY have granulosa cell tumors (GCTs).

These common tumors of the reproductive tract are often benign, but have historically been associated with issues such as aggression and stallion-like behavior. However, a recent UC Davis study showed that only stallion-like behavior was associated with GCTs. Other abnormal behaviors, such as aggression and estrous-cycle behaviors, were not associated with GCTs (Huggins et al. 2023). Thus, undesirable behaviors or abdominal discomfort are unlikely to be associated with ovarian hormones.

8 Lymphoma is the most diagnosed malignant cancer in horses. It affects tissues that contain lymphocytes, white blood cells that help the body fight disease and infection. This includes lymph nodes, thymus, spleen, and linings of the digestive, respiratory, and urogenital tracts. Horses 4 to 10 years old are more commonly affected, but it can occur at any age. No specific risk factors have been identified. Clinical signs are non-specific, so affected horses are typically diagnosed in the late stages of the disease. Horses that are only affected in their skin (cutaneous lymphoma) tend to have a better prognosis than those with lymphoma affecting internal organs. Treatment options include surgery, radiotherapy, and chemotherapy, with response dependent on type and extent of disease.

9 The cause of most equine cancers is unknown, but there are ways to lower cancer risk.

Regular sheath cleaning to reduce smegma accumulation, reducing exposure to excessive sunlight (especially in light-colored horses by providing shade, utilizing sunblock and UV blocking fly masks), and general cleanliness are important for prevention of tumors.

10 The key to successful cancer treatment is early diagnosis. Regular grooming is a good time to look for small lumps and bumps. Treat these seriously and have them examined by a veterinarian. Seek early veterinary assistance for skin abnormalities that persist for a few weeks, or if a new lesion develops around the original lesion or in a new location on the body.



Some horses are prone to developing sarcoids.



Melanoma is common in older gray horses.



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CEH TEACHING HERD HORSES

The 150 horses that call CEH home had a busy year teaching veterinary students, residents, graduate students and undergraduates. They participated in summer programs, providing hands-on learning opportunities to high school students through recent college graduates. They were also integral to research and outreach efforts at the center.

The CEH Teaching Herd Horses are at the heart of all that we do and are critical to our mission. Our dedicated staff know each horse's personality, history, and contributions and work hard to ensure that they thrive in their second careers with us.

The welfare of all horses depends on continuous advancement in equine health. Through research and educational efforts, CEH provides new information and improved diagnostic and therapeutic options to benefit horses.

The CEH Teaching Herd Fund helps provide daily and specialized care for these amazing horses. Donations to this fund can be made online at <https://give.ucdavis.edu/VCEH/V407THS> or by calling (530) 752-7024. Your support for our herd makes a difference for horses everywhere.

