

## Wounds in Horses: An Overview

MVZ Cert. Elena Garcia-Seco, MVZ Ms. Cert. Mariano Hernández Gil  
Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México

Wounds in horses are common and can have significant implications for their health and well-being. Understanding the different types of wounds, their causes, and appropriate treatment options is crucial for equine owners, veterinarians, and caretakers. Wounds can be classified into several categories, including incised wounds, lacerations, puncture wounds, abrasions, and avulsions. Incised wounds are characterized by clean, sharp cuts, whereas lacerations refer to irregular, torn wounds. Puncture wounds are caused by sharp objects penetrating the skin, while abrasions result from friction or scraping injuries. Avulsions involve the tearing away of tissue from its attachment site.

Several factors contribute to the occurrence of wounds in horses. External factors such as accidents, falls, or interactions with sharp objects can lead to traumatic injuries. Additionally, horses housed in crowded or poorly maintained environments are more prone to injuries. Internal factors, including poor nutrition, weakened immune systems, or underlying health conditions, can also increase the susceptibility of horses to wounds.

Proper wound management is essential to minimize complications and promote healing. The initial step involves cleaning the wound thoroughly to remove debris and reduce bacterial contamination. For larger wounds or those involving vital structures, immediate veterinary attention is necessary. Wound closure techniques, such as suturing, stapling, or tissue adhesives, may be employed depending on the severity and location of the wound. Antibiotics and tetanus prophylaxis are often administered to prevent infection.

Preventing wounds in horses involves implementing various strategies. Regular inspection of the horse's environment, including fencing, stalls, and pasture, can help identify potential hazards. Providing proper nutrition and maintaining a healthy immune system through balanced diets and appropriate vaccinations can also reduce the risk of wounds. Additionally, implementing safe handling practices and using protective equipment, such as leg wraps or boots, can minimize the occurrence of injuries.

By implementing appropriate wound management techniques and preventive measures, the occurrence of wounds in horses can be minimized, promoting a healthy and safe environment for these magnificent animals. Enviado desde mi iPhone

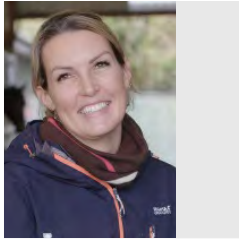
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***MVZ Cert. Elena García Seco***

*Born in Mexico, Elena obtained a First Degree (Hons.) in Veterinary Medicine and Animal Science by the National Autonomous University of Mexico (UNAM). She performed externships at the University of California Davis and the University of Minnesota. She then achieved an Equine Internship at Louisiana State University, a Residency in Equine Surgery at the University of Missouri and a Clinical Instructorship in Surgery at the Marion duPont Scott Equine Medical Center of Virginia Tech. Worked as a professor and surgeon at the Universidad Alfonso X in Madrid and since 2013, she is a Faculty Member of the Equine Department at the College of Veterinary Medicine (UNAM) taking part as an equine professor and a senior surgeon.*



## Making the best of Limited Resources for Difficult Wounds

Nov 10<sup>th</sup> 2023 – Hall 2 (9:00 – 9:30)

Francesca Compostella

DVM, MRCVS, MSC(One Health)

SEA Exec Director of Veterinary and Welfare for Saudi Arabia and WVS Int Project Director (Large Animal)

Are wounds a prevalent condition veterinarians face in the field? Data demonstrates that wounds are in the top 3 most diagnosed conditions amongst working horses. And while you may feel that not much can be done when you don't have many medications and drugs available, even few resources can be extremely efficient when the wound is best assessed.

So when faced by challenge, try to remember this invaluable statement:

Triaging and assessing a wound is one of the most important steps in wound therapy.

More repaired wounds fail because of improper preparation and assessment rather than improper therapy. And while there is no doubt that working with limited resources can be challenging, and that the conditions will test your "inventive" nature... with careful monitoring of the progression and evolution of these wounds, we can still treat the vast majority of them.

During this brief talk we will walk through the steps required to address a wound, sharing some tricks of the trade, picked up over years of addressing wounds with nothing more than a few items in our treatment bag.

The triage steps we will review and address will include:

An objective evaluation of your patient's behavior and general health

A detailed examination and assessment of the wound itself.

Review of the potential cause/reason of injury

Assessment of the space/time and resources (both in equipment and man skills) available for and during the recovery phase

Wound preparation, treatment and dressing.

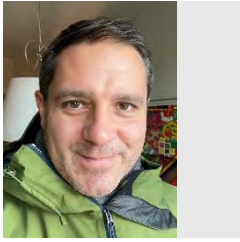
Ongoing management

This is a highly interactive session where all participants are welcome to share their hands on experiences and thoughts.

### **Francesca Compostella, DVM, MRCVS, MSc**

*Veterinary & Welfare International Director WVS*

*Dr. Francesca Compostella has worked in the development sector since completing a surgical residency in 2012. Having grown up in Mozambique she has always been passionate about the human animal bond, and the incredible role animals hold in supporting communities. Her focus is on promoting education at all levels, where she applies a One Health approach to maximize the limited resources faced in some parts of the world. She is currently designing, implementing, and leading International projects on behalf of WVS.*



## The infected wound

Christoph Koch, DACVS & ECVS, Prof. Dr. med. vet., Division of Equine Surgery, ISME Equine Clinic Bern, Vetuisse Faculty of the University of Bern, Switzerland

Wounds that have been managed by primary (or delayed primary) closure as well as wounds that have been left to heal by second intention can get infected and often require veterinary attention. Understanding the basics of wound healing and knowing underlying problems and factors that predispose to wound infection are essential in helping prevent, recognize, and adequately address wound infection in equids.

Excessive swelling, pain on palpation or associated with movement (lameness), wound discharge, and sometimes systemic signs of infection like fever, are indications of wound infection. Wounds managed by primary closure may get infected because of pre- or intraoperative bacterial contamination, and/or because factors like inadequate vascular supply (including bone sequestration), inadequate drainage, or excessive tension on the primarily adapted wound margins could not be eliminated or were simply not recognized and addressed as such. Infected primarily closed wounds are treated by removing suture material to provide passive drainage, additional incisions and lavage with dilute antiseptic solutions if needed, and if needed (depending on the nature and anatomic localization of the wound) systemic antimicrobial therapy based on antimicrobial sensitivity testing. Examples include incisional infection after primarily closed orthopedic lacerations and injuries with or without implants, or abdominal incisions after colic surgery.

Infected wounds left to heal by second intention, may present as slowly healing wounds with a prolonged inflammatory or proliferative phase with excessive discharge, or with a distinct lack of granulation tissue, or dark red and disrupted surfaces of granulation tissue, or with the formation of proud flesh. Gross contamination with bacteria or foreign material, particularly of deeper wound cavities and wounds with substantial disruption of the underlying blood supply, the presence of necrotic tissue (including bone sequestration), and excessive movement (particularly on wounds of the distal extremities) are causes of wound infection and wound healing disorders. In first aid situations, meticulous wound debridement and ensuring unrestricted drainage are important measures to help prevent wound infection for deep, contaminated wounds that are left open to heal by second intention. Thus, wounds healing by second intention may get infected days and even weeks after the initial insult, because they lack an epidermal and dermal tissue barrier to prevent bacterial colonization of deeper tissue layers until these are protected by a healthy bed of granulation tissue. Examples include degloving injuries or comminuted, open fractures of proximal splint bones. Moreover, traumatic extremity wounds may be predisposed to wound infection because the formation of protective granulation tissue can be delayed by the constant movement of exposed ligaments or tendons. These factors need to be recognized and considered when presented with such wounds in acute or chronic stages. Different possibilities and equipment for surgical and biological debridement of necrotic tissues, and bandaging techniques to optimize the wound environment with the correct choice of wound dressings, splints or casts for effective immobilization will be presented and discussed.

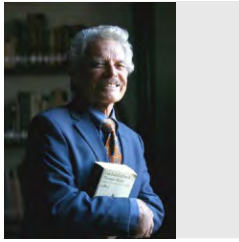
### **Christoph Koch Mercier, Prof. Dr. med. vet.**

*Computer-assisted surgery, Equine sarcoid disease, general large animal surgery topics  
Head of Equine Surgery and Deputy Head of the ISME Equine Clinic Berne, Vetsuisse, University of Berne, Switzerland.*

*Supervising Clinical Faculty / Lecturer in Equine Surgery, ISME Equine Clinic Berne, Switzerland.*

*Resident in Large Animal Surgery, University of Wisconsin Madison, Madison WI, USA.*

*Intern in Equine Surgery, Hagyard Equine Medical Institute, Lexington KY, USA.*



## Fistulous tracts in the horse

Msc. Rubén Anguiano Estrella

Veterinario de equinos Universidad de Guadalajara, Universidad de Michigan, USA diplomado y certificado en Medicina y Cirugía de Equinos Cel: 33 3667 7803/ 33 3199 9956 e. Mail: rubenanguianomsc@gmail.com

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### Abstract

Fistula "Fistulous tracts" Is an abnormal passage or communication usually between two internal organs or leading from one organ to the surface of the skin.

Some of the fistulous tracts include a tendon sheath and a joint (synovial fistula), from the intestine through the abdominal wall (enterocutaneous or parietal fistula), between the mouth and skin (orocutaneous fistula). Fistulas could have one entrance and multiple "rabbit hutch's" (meerkat).

Many other structures, organs, tissues and any bone of the horse could fistulated to the body surface (Bone sequestra).

Sinus tract is an abnormal cavity, channel or fistula permitting the escape of pus through the skin. Fistulas and sinus tracts are often used interchangeably or considered similar.

Fistulas commonly occur secondary to trauma, surgical or accidentally, foreign bodies (wood, metal, sands, small rocks, plastic, suture material, implants like mesh and orthopedic material).

Fistula could have genetic and iatrogenic etiology.

Fistula diagnosis requires scrupulous clinical exploration. Fistulas produce soft tissue chronic draining, soft tissue swelling, thickening, gas densities, periosteal reaction and chronic draining. Complement of the diagnosis include X-Ray, ultrasound, fistulograms and bacterial cultures.

Therapy requires surgery, medical therapy and bacterial sensitivity (antibiogram).

### **MVZ. MSc. Ruben Anguiano Estrella**

*Equine academic and researcher at the Veterinary Sciences Division of the University of Guadalajara (UDG), Mexico, for 52 years. Post-graduated at Michigan State University USA. Director and Chief Surgeon of the Equine Health Center "Los Alamitos" in Guadalajara, Jalisco, Mexico. Founder and Director of the Program for the Protection and Comprehensive Health of Equines belonging to owners without financial resources in Guadalajara, Jalisco, Mexico. National and International Consultant in Equine Medicine and Surgery. Ambassador of the World Association of Equine Veterinarians WEVA for Mexico, Central America and the Caribbean*



## Tumor transformation causes significant wound healing failure; always consider this when a wound fails to heal as expected.

DEREK C KNOTTENBELT OBE, BVM&S, DVM&S, DipECEIM, DACVIM(LA), MRCVS  
Equine Medical Solutions Ltd, 146 DRIP ROAD, STIRLING, SCOTLAND G63 9QB  
knotty@equinesarcoid.co.uk

There is always a reason why a wound does not heal. Furthermore, the relationship between a normal healing process and the development of a de novo tumor within the wound bed is well recognized. It has been said that a wound is a tumor that heals and a tumor is a wound that does not heal and it is this relationship that arises in the horse in particular. Mesenchymal stem cells (MSC's) that localize at perivascular sites respond rapidly to external stimuli and with the vascular and immune systems lead to successful wound healing. Cancer in some circumstances can be considered to be a wound that never heals; this is accompanied by changes in MSCs that parallel the wound-healing response. MSCs are now recognized as key players in tumorigenesis (Li et al., 2019). It is easy to imagine that the healing process can be transformed into an unstable genetic situation culminating in primary tumorigenesis. Tumor dormancy is also considered to be one of the major unsolved questions in cancer biology. Increasing evidence points to tissue trauma and subsequent wound healing as contributing events in escape from dormancy leading to tumor development.

INHIBITORY FACTOR	
1.	INFECTION
2.	MOVEMENT
3.	FOREIGN BODY
4.	NECROTIC TISSUE
5.	TISSUE DEFICIT
6.	CONTINUED TRAUMA
7.	IMPAIRED BLOOD SUPPLY
8.	POOR OXYGENATION
9.	<b>HEALTH STATUS</b>
10.	LOCAL FACTORS
11.	IATROGENIC FACTORS
12.	<b>TUMOR TRANSFORMATION</b>

A.	DESICCATION
B.	MACERATION
C.	HIGH/LOW TEMPERATURE
D.	pH
E.	DEAD SPACE
F.	FLUID ACCUMULATION
G.	EXUDATE / DISCHARGES
H.	TENSION

TABLE1: The recognized acquired factors that inhibit healing processes in wound sites – these apply no matter what the cause of the wound in the first place.



It is important to identify the common regulators of wound repair and tumor formation and to unravel their functions and mechanisms of action. The recognized factors that are involved in inhibiting wound healing are shown in Table 1. This table illustrates the diagnostic process that should be considered when a wound fails to heal; there are clear relationships between the various factors making the management of non-healing wounds problematic. For sure, tumor transformation is a very serious long-term challenge and while tumor cells exist in the wound bed, healing will be inhibited usually to a significant degree either focally or more generally in the periphery or the wound bed or both.

Although neoplastic reasons for wound healing failure are probably are they are extremely important since no matter what other measures are undertaken the wound will not heal if any component of neoplastic tissue is present. Of course, there are several pathways that have an influence on the healing process in respect of neoplastic inhibition of wound healing.

1. **The systemic cancer case:** The first is the concept that horses with significant tumors affecting any part of the body are likely to have paracrine/paraneoplastic subtle effects on the function of the immune system and specifically on wound healing. Wounds on unhealthy horses often fail to heal. There are many complex reasons for this. Advanced age, immunosuppression, malnutrition, and co-morbidity, particularly with systemic tumors such as lymphoma often have a profound influence on the healing process. Wounds do not present detached from the patient! There is always a horse involved and so it is incumbent upon the clinician to examine the patient to establish the presence of factors that might inhibit the healing process including neoplastic disease. However, systemic or cutaneous neoplasia is not always obvious and in the former group, paraneoplastic signs may be all that are detectable clinically at the time.
2. **Tumor development within a wound site (spontaneous tumorigenesis):** The link between wound healing and tumorigenesis has attracted much attention in the human medical sphere. ( Dillekås & Straume, 2019) Following an acute injury, resident and non-resident cell populations instigate the natural [beneficial] wound healing responses; classically these involve temporary, controlled, and coordinated increases in inflammation, extracellular matrix production, and proliferation with the objective of restoring normal organ architecture leading to a functional repair. However, the ongoing failure of wound healing evokes a perpetuating wound-healing response in which cytokine activity, including low-grade persistence of TGF- $\beta$ , is abnormal (Wilmink, van Weeren et al., 1999) promoting the development of fibrosis, organ failure, and cancer.
3. Toll-like receptors (TLRs) act as sensors of danger signals in injured tissue to switch the wound healing response toward fibrogenesis and regeneration as a protective response to imminent danger at the cost of an increased long-term risk of developing cancer transformation.

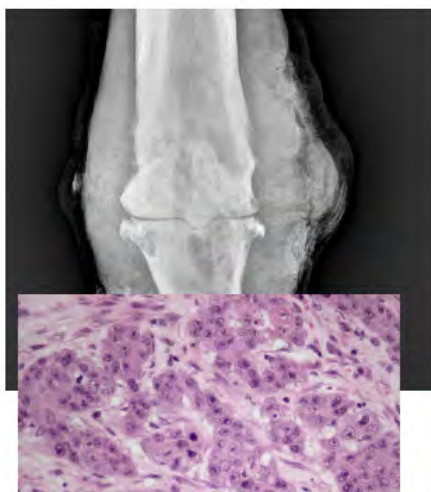


Figure 1: A relatively minor skin wound occurred some 14 months previously. This failed to heal and was found to have an aggressive carcinoma with major local effects.



The commonest spontaneous tumor occurring in wound sites in horses is carcinoma (Fig 1).

Hemangiosarcoma is probably the third most common tumor transformation in a wound site (Figure 2). It is perhaps a little more understandable than the other tumor types in view of the prominent role neovascularisation has in the healing process as mentioned above.

**The traumatized cancer site:** Here the tumor pre-exits the wound either obviously or undetectably. Traumatizing a tumor is a well-recognized cause of tumor progression. A good example of this is the equine sarcoid; here this effect is very common. In this situation, it is likely that the vast majority of affected sites that are traumatized, either accidentally or intentionally by incomplete surgical removal or by biopsy (without the expectation of a total tumor removal of course), results in an "expected" significant exacerbation of the tumor both in growth rate and aggression.

As might be expected incomplete removal of tumor results in a failed surgical site – even a single cell can create a significant delay in healing and oftentimes the proliferation of the tumor is often mistaken for [exuberant] granulation tissue (Figure 5).



*Figure 2 a/b : A: An intramuscular injection of procaine penicillin was administered here 8 weeks previously. The horse had no other obvious sarcoids but sarcoid was confirmed at the site histologically*

*B. An intravenous sedative had been administered 3 weeks previously to facilitate a biopsy of a sarcoid-like lesion on the tarsal region. A complex sarcoid lesion developed here within the time scale. The moral of this is to remember that a wound does not have to be big for tumour to develop within 1 and that all due precautions are needed.*

The second way in which a wound can be transformed is a rather unique process involving the equine sarcoid. Transference of cells from one sarcoid site to a second site (whether the destination is another sarcoid tumor or not) is entirely possible. .

Notwithstanding the complexity of the pathogenesis of tumor transformation in general and in wound sites in particular, this possibility is one of the most dangerous causes of incipient wound healing failure. The "transformed wound" is often immunocompromised locally and so infection and other issues are often considered first. The value of an early histologic investigation in identifying any significant factor responsible for wound healing failure cannot be overstated. The fact is however that we have no meaningful data on the incidence of tumour-inhibited wounds and even less on the full range of potential neoplasms involved.

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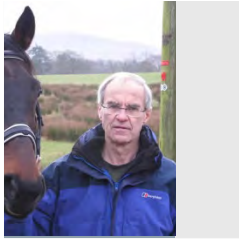
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10. Emeritus Professor Derek C. Knottenbelt
11. OBE, BVM&S, DVM&S, DipECEIM, DACVIM, MRCVS

**Professor Derek Knottenbelt** qualified from Edinburgh in 1970 and retired from his personal Chair in Equine Internal Medicine Liverpool in 2010. He is a Diplomat of the European College of Equine Internal Medicine and of the American College of Veterinary Internal Medicine. He is the Director of Equine Medical Solutions Ltd and through this provides an advisory service in equine oncology. He is the primary author of 10 recognized textbooks and over 90 refereed scientific papers. He has been awarded honorary life membership of ECEIM, BEVA, VWHA and ACVIM. He received the Animal Health Trust Scientific Award in 2003, the BEVA (Blue Cross) Welfare award in 2004, and the Merk -WEVA Welfare Award in 2006. In 2005 he was appointed OBE by the Queen for his services to equine medicine. Through Equine Medical Solutions Ltd he continues to provide a consultancy service in equine oncology and other challenging clinical conditions for veterinarians worldwide. His main interests are in oncology, ophthalmology, wound management, and dermatology. He is actively involved in animal and human charity work both in the UK and abroad.



## What is the value of cancer surgery in horses? Is it practicable, humane and to the betterment of the welfare of affected horses?

DEREK C KNOTTENBELT OBE, BVM&S, DVM&S, DipECEIM, DACVIM(LA)), MRCVS  
Equine Medical Solutions 146 DRIP ROAD, STIRLING, SCOTLAND

knotty@equinesarcoid.co.uk

Neoplastic prevalence surveys in equids confirm that most primary tumors are cutaneous. These are fortunately easily seen/palpated and sampled. Non-cutaneous neoplasms are less accessible and more difficult to diagnose. Surgery is widely regarded as the mainstay of cancer therapy in horses, The options for surgical intervention include sharp surgery, laser excision, cryosurgery, RF-electro cautery, electrochemotherapy, and surgical ligation. Additionally, chemotherapeutic immunotherapy and radiotherapeutic options can be used adjunctively where relevant. It is certainly true that for almost all cancer therapy in other species including man, the use of multimodality treatment is de rigeur. In equine cancer medicine, however, this is regrettably not the case and while surgery is clearly a major player in the potential resolution of tumors, good results possibly rely more on good fortune than oncological rationale. The concept of multimodality treatment with surgery needs to be developed. However, the range of therapeutic options with evidence is very narrow and limited by circumstance, availability, and expertise.

Since most accessible tumors will be either sarcoid, melanoma, carcinoma or mast cell tumors, these are the main target for most surgical treatment.

### 1. Is surgery and effective way of resolving the equine sarcoid?

This is one of the most dangerous tumors in terms of the requirement to remove every single solitary cell. Leaving a single cell behind is probably going to result in a significant recurrence and usually with significant exacerbation. A rather benign-looking occult or verrucose sarcoid that is incompletely removed will almost always develop into an invasive dangerous and difficult fibroblastic complex and in any case the resulting wound will fail to heal (Figure 1).

### 2. Does surgery work for the removal of melanoma lesions?

Historically, the profession has carried a negative and harmful dogma of neglect that stated that disseminated malignancy was certain after minor surgical interference. In fact, over 80% of melanoma lesions will become malignant if they are left long enough, and there is absolutely no justification to leave them. The metastatic spread of equine melanoma is extremely inefficient. The blood-borne metastatic cells are delivered to the pulmonary circulation where they are filtered out in congregated masses. This filtration system is extremely efficient but some cells will escape this filtration mechanism. According to Paget hypothesis, neoplastic cells in the pulmonary parenchyma are held in G0 and cannot grow into meaningful tumors; the environment is not suitable for the development of metastatic tumor in the lung tissue itself. However, any cells that escape this filtration mechanism can invade any organ or structure – some with greater tolerance and higher replicative speed and devastating consequences. The metastatic spread occurs very early – often long before tumors become apparent; malignancy starts with a single cell – it does not start in big tumors or little tumors – it just starts wherever it needs to. This therefore means that there is an obligation and a professional responsibility to remove all external melanoma lesions as early as possible; if they are malignant already, they must be removed to reduce the amount of metastatic spread and if they

are not malignant yet, they are likely to become so and therefore, must be removed. There is absolutely no justification to allow any melanoma lesion on any horse at any time. Melanoma in non-grey horses is even more serious and there can be absolutely no delay here; histology is critical in these cases.

**3. Can squamous cell carcinoma be resolved surgically**

The challenge with squamous cell carcinoma is the definition of the outer limit of the tumor since there invade lymphatics and blood vessels and the fact that squamous cell carcinoma tumors are quite frequently destructive. This makes the reconstruction of excised tumor very challenging.

Where they are in the proliferative form, they are technically much easier to remove surgically. Surgical pathology and concurrent chemotherapy are obligatory in all cases. For example, removal of a small localized penile carcinoma could reasonably be assumed to have an effective and safe surgical margin but it may not, and since carcinoma tracks along blood vessels and more particularly along lymphatics, the lymph-node interpretation proximal to the lesion itself is a very important prognostic indicator as to whether surgical intervention is likely to be successful or not. On the other hand, phallectomy is often used to deal with extensive distal penile carcinoma and a variety of different surgical methods are available to cope with this circumstance.



*Figure 1: a total clitoridectomy followed by extensive intralesional chemotherapy with carboplatin emulsion resulted in a very satisfactory conclusion. It was not easy and not every case turns out as well as this because carcinoma is extremely unpredictable*

*Figure 2: a highly malignant penile carcinoma was identified as a very late presentation having had multiple antibiotics and other minor interferences for the past 4 years up a distal phallectomy was performed as a palliative procedure because the inguinal and sub-iliac lymph-node's were already grossly enlarged and therefore, the likelihood a satisfactory outcome was very low but gave the horse some months of normal behaviour and relief. Concurrent medication with piroxicam was instituted from the outset.*

**4. Once diagnosed, what are the surgical implications for mast cell tumor removal?**

There is considerable debate about the true nature of the equine mast cell tumor (mastocytoma). It is not clear whether this is a genuine tumor or not. In any event, they do have a lot of the characteristics associated with neoplastic disease, and surgical removal of mast cell tumors is the treatment of choice. . Therefore histological confirmation. These lesions can become very big and very aggressive and others are small and easily removed; it is always better to remove a small tumor in the expectation of it getting larger and becoming impossible rather than waiting until it is impossible and then regretting having not interfered earlier. All mast cell tumor lesions should be removed surgically. Partial removal does not appear to be harmful and therefore, whilst in some circumstances, some dangers are easily envisaged, removal of the bulk of the tumor seems to result in a significant long-term benefit. Malignant mast cell tumors are extremely rare in horses and there is no evidence one way or the other as to whether dissemination can follow a surgical intervention – it just seems unlikely!

## 5. What about surgery for other tumors?

Other tumors can be removed successfully including those of the skin. For the most part, however, the removal of troublesome lesions seems to be the target. Where there are pathological consequences such as for example a retrobulbar lymphoma, a strangulating pedunculated lipoma, or an obstructive gastrointestinal stromal cell tumor, removal can be challenging but very rewarding. Since there are around 60 different tumor types in horses, we need to understand which ones of these are going to carry the best surgical prognosis. Some will be totally impossible as surgical options – a good example is a gastric carcinoma but of course whenever surgery is considered in terms of neoplastic disease, all the evidence must be accumulated and understood so that the right decision is made at the outset. However, as a general rule, we would advocate strongly that where ever surgery is performed, concurrent chemotherapy should be considered. The most basic requirement is to establish a diagnosis and to understand the pathological and therapeutic behavior of each tumor type. Reliance on a sole surgical approach is not usually enough even for sarcoid and carcinomas.

The problem is that there is very little evidence for any particular pathology—we need the evidence and we need constructive careful and thinking veterinarians to build this evidence so that we can do right by our cancer patients – equine oncology is probably 50 years behind anything else and is belittled and ignored by many in our profession – we must change that!

### Further Reading

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### **Emeritus Professor Derek C. Knottenbelt**

*OBE, BVM&S, DVM&S, DipECEIM, DACVIM, MRCVS*

*Professor Derek Knottenbelt qualified from Edinburgh in 1970 and retired from his personal Chair in Equine Internal Medicine Liverpool in 2010. He is a Diplomat of the European College of Equine Internal Medicine and of the American College of Veterinary Internal Medicine. He is the Director of Equine Medical Solutions Ltd and through this provides an advisory service in equine oncology. He is the primary author of 10 recognized textbooks and over 90 refereed scientific papers. He has been awarded honorary life membership of ECEIM, BEVA, VWHA and ACVIM. He received the Animal Health Trust Scientific Award in 2003, the BEVA (Blue Cross) Welfare award in 2004, and the Merk -WEVA Welfare Award in 2006. In 2005 he was appointed OBE by the Queen for his services to equine medicine. Through Equine Medical Solutions Ltd he continues to provide a consultancy service in equine oncology and other challenging clinical conditions for veterinarians worldwide. His main interests are in oncology, ophthalmology, wound management, and dermatology. He is actively involved in animal and human charity work both in the UK and abroad.*



## Equine Oncology cases in Chile

Durán Graeff, Carolina<sup>1</sup>; Ojeda Oyarzún, Javier<sup>2</sup>

Durán Graeff, Carolina; DVM, MVetSc, PhD, Dipl. ACVIM; Associate Professor UACH; carolina.duran@uach.cl

Ojeda Oyarzún, Javier; DVM, MSc; Associate Professor UACH; javierojeda@uach.cl

<sup>1</sup>Equine Hospital, Institute of Clinical Sciences, Faculty of Veterinary Sciences, Universidad Austral de Chile, Valdivia, Chile.

<sup>2</sup>Small Animal Hospital, Institute of Clinical Sciences, Faculty of Veterinary Sciences, Universidad Austral de Chile, Valdivia, Chile.

Equine neoplasias in Chile, as in the rest of the world, are rather uncommon. Nevertheless, skin neoplasias are the most frequent ones, including sarcoids, melanomas, squamous cell carcinomas [1].

Common clinical signs depend on the size and location of the masses, generally small bulging masses appear on face, neck, extremities and/perineal areas, and speed of growth and appearance will vary depending on the mass. There is no real sex or breed predisposition, but depigmented skin and advanced age are risk factors to develop melanomas and carcinomas. Definitive diagnosis should be based on histopathology results. Treatments such as surgical excision, cauterization, cryosurgery, radiation, electrochemotherapy (ECT) have been reported.

ECT is a newer treatment that generally involves intratumoral injection of chemotherapeutic drugs followed by repeated electrical current to increase intracellular drug concentrations and by this, increase exponentially cytotoxic effects in neoplastic cells [2].

In our experience, ECT with local injection of cisplatin or bleomycin alone can be a very good treatment option with excellent results after 1-3 treatments, with or without surgical resection (Fig. 1). Typically, 1-3 treatments, 2-4 weeks apart are required. More treatments (6-12) are needed with chronic and/or severe presentations [personal experience]. However, it is common to receive horses in very advanced stages of disease, with large tumors where ECT alone may not be effective or will require too many treatment sessions. In these cases, in small animals, the combination of ECT with other treatment modalities is very effective [3]. The use of intravenous bleomycin is generally recommended for all small animal cases, regardless of the size of the lesion. This route reaches an adequate distribution and concentration of the drug in the tumor and its margins, avoids leaving areas of the tumor with insufficient drug concentration due to errors in the intratumoral administration technique, drug administration is safer for the handler, by itself it is an immune system activator, contributing to the local immune response induced by the treatment [3].

In horses the use of the IV route of bleomycin is costly considering the high volumes of drug required, and little evidence about the safety of the drug in this species. Also, the IV route should be avoided in animals that may be destined for human consumption.

We have used systemic bleomycin as an adjuvant chemotherapeutic approach in patients with large skin neoplasias (2 patients with sarcoids Fig.2, 1 patient with perianal melanomas). Results have shown that the treatment of ECT combined with local and intravenous administration of chemotherapeutic drugs in horses was well tolerated and successful in treating chronic and large fibroblastic sarcoids and melanomas, after 2-4 treatment sessions. Although this treatment approach is costly and must be performed under general anesthesia, increased treatment efficacy implies less treatment sessions.



ECT in conjunction with local and/or intravenous chemotherapeutic drugs is certainly a promising treatment approach for equine skin neoplasias. Nevertheless, further studies with larger sample sizes are required to reach consensus about the use of this rather newer therapy approach in horses.

## Figures



## References

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**Dr. Carolina Durán Graeff** graduated from the Universidad de Chile in 2007, worked at Rood and Riddle Equine Hospital (Lexington, KY, USA) and then completed a 2-year rotating equine internship- and a PhD at the Equine Clinic of the University of Veterinary Medicine Hannover. Next, she moved then to Canada where she completed three-year residency in Large Animal Internal Medicine and a master's in veterinary sciences at the University of Saskatchewan (Saskatoon, Canada). In July 2016 she became the first Chilean -board-certified-specialist in large animal medicine of the "American College of Veterinary Internal Medicine (ACVIM)". After working as an internist at the Equine Clinic of Ludwig-Maximilians-University for two years, in 2019 she moved back to Chile where she is an associate professor and now in charge of the Equine Clinic of the Universidad Austral de Chile.

Her main areas of research are equine infectious diseases, equine oncology, and large animal internal medicine. She is a member of the scientific community of ACHVE, as well as of the specialty committee of the Chilean association of veterinary medicine faculties. Dr. Durán commonly peer-reviews professional publications including those for *Animals*, *Veterinary Research*, *Journal of Veterinary Behaviour*, *Austral Journal of Veterinary Sciences* and other high-quality journals.