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Background & Objective

Equine sarcoid is the most diagnosed skin neoplasm worldwide, occurring in approximately 46 % of all neoplastic cutaneous biopsy samples. Its incidence ranges between 12.5 % to 67 % of all neoplasms. It develops anywhere on the skin, but most commonly on the chest, groin, sheath, and face especially around the eyes and mouth. Equine sarcoids are caused by bovine papillomavirus types 1 and 2 (BPV 1, BPV 2), which is the only known papillomavirus infection between different species. Although there are six distinct types of sarcoids that differ in appearance and behavior, including occult, verrucous (wart-like), nodular, fibroblastic, mixed and malevolent, many individual tumors may exhibit characteristics of several different types. They are rarely metastatic but can be life timing due to locally aggressive invasion and secondary ulceration and infection. Regardless of treatment, recurrence is likely. Various treatment protocols have been reported, including sharp or laser surgical excision, cryosurgery, topical or intratumoral chemotherapy, and immunotherapy. In addition, there are reports of electrochemotherapy or radiation therapy techniques such as interstitial brachytherapy or plesiotherapy.^{1,2,3}

We report on the clinical case of a six-year-old Hanoverian mare with severe clinical history of periorbital sarcoid. After trying various treatment methods, the owner decided on autologous dendritic cell (DC)-based immunotherapy of the sarcoid, in the hope of ensuring the horse's well-being and the integrity of the eye and avoiding euthanasia. ¹Offer, K.S., Dixon, C.E., Sutton, D.G.M., 2024. Treatment of equine sarcoids: A systematic review. *Equine Vet. J.* 56, (1) 12-25. <https://doi.org/10.1111/evj.13935>; ²Taylor, S., Haldorsen, G., 2013. A review of equine sarcoid. *Equine Vet. Educ.* 25 (4) 210-216; ³Clements, J., 2014. Sarcoids. *The Royal (Dick) School of Veterinary Studies. The Dick Vet. Equine Practice.*

Anamnesis & Diagnosis & Prognosis

Anamnesis

- Date of receipt 13/06/2024, breed: Hanoverian, sex: mare, date of birth: 17/05/2018, body weight: 600 kg.
- In 08/2019, a pedunculated sarcoid was removed from beneath the left lower left eyelid without being completely excised, leaving no safety margin to the healthy tissue. In 2020, gradual development of recurrent sarcoids periorbital of the left eye accompanied by multiple nodules (estimated n = 10) on the inner side of the left and the right hind limbs. During the period from 2020 to 2024, various therapeutic approaches pursued: several homeopathic treatments, tuja extracts, Canadian bloodroot cream (XXTERRA®), Immunocidin® Equine, liposomal turmeric, ligation of smaller nodular sarcoids in the inner area of both hind limbs, photodynamic therapy with red light laser (photoactivated chemotherapy (PACT)).
- Specific examination of the skin: fleshy and partially bleeding walnut-sized sarcoid tissue with ulcerated surface ("proud flesh") found along the ventral line of the eyelid, and a hazelnut-sized sarcoid in the temporal corner of the eye, both in transition from nodular into more dramatic form, such as fibroblastic type (Figs. 1 + 2). In addition, numerous nodular sarcoids were found along the right and left inner limb region.



Figure 1. 05/06/2024 prior to DCs treatment.



Figure 2. 10/06/2024 prior to DCs treatment

Diagnosis

- Periorbital sarcoids of the left eye accompanied by multiple sarcoids along the right and left inner limb region.
- Based on clinical symptoms, and previous treatment attempts according to medical history.
- Mixed (nodular/fibroblastic) type.

Prognosis

- Cautious to good.
- "Once a sarcoid horse, always a sarcoid horse!"
- High recurrence rate.

Dendritic Cells

Dendritic cells (DCs)⁴

- DCs derived from peripheral blood monocytes of the equine patient.
- $\geq 4 \times 10^6$ cells required for in-vitro culture in RPMI 1640, rhGM-CSF and reIL-4, GMP, seven days.
- Acceptance criteria for release: $\geq 10\%$ of MHC-II positive cells, cell viability $\geq 90\%$.

⁴Spiller, V., Vetter, M., Dettmer-Richardt, C., Grammel, T., 2024. *Vet. J.* 306, 106-96. <https://doi.org/10.1016/j.tvjl.2024.106196.0>

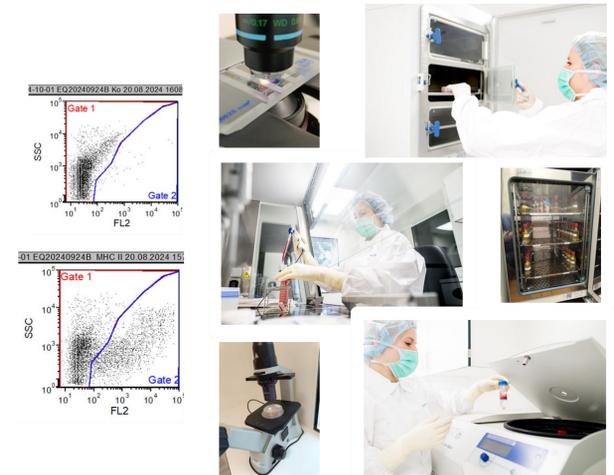


Figure 3. Preparation and quality control of equine autologous dendritic cells by means of cellular methods and FACS analysis.

DC-Immunotherapy & Progression of Disease

DC Immunotherapy

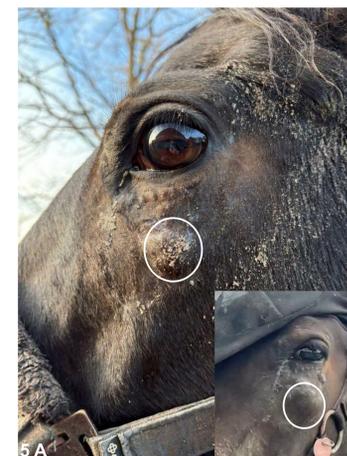
- Dose: DCs $\geq 5 \times 10^4$ / 2,5 ml of isotonic sodium chloride solution (0.9 %).
- Two doses (5 ml), intradermal injection within 24 hours.
- Vaccination (V) schedule:
 - V 1) 49.6×10^6 , 21/06/2024
 - V 2) 7.3×10^6 , 18/07/2024
 - V 3) 43.7×10^6 , 15/08/2024
 - V 4) 25.5×10^6 , 12/09/2024
 - V 5) 20.8×10^6 , 05/12/2024
- At the same time as immunotherapy, anthelmintic treatment with fenbendazole and ivermectin.

Progression of Disease

- Figures 4 (A+B) + 5 (A+B)
- During the period of 06 to 12/2024, five intradermal autologous DC treatments were performed.
- The periorbital sarcoids healed completely; a raised area approximately two-€ coin in size remained visible.
- The nodular sarcoids on the inside of both hind limbs also disappeared.



Figures 4 A + B. After 2nd DC injection on 19/07 (A) and 02/08/2024 (B)



Figures 5 A + B. After five DC injections completed 09/03/2025 (A) and 23/03/2025 (B); a circle indicates a visible raised area approximately the size of a two-€ coin.



Discussion & Conclusion

- In 08/2019, the 15-month-old Hanoverian mare was diagnosed with a single pedunculated sarcoid under her left eyelid. Surgical removal was incomplete because the safety margin to healthy tissue could not be maintained. In 2020, several nodular sarcoids appeared around the left eye and on both inner sides of the hind legs. After various treatment attempts and a deterioration from nodular to fibroblastic tissue type, the sarcoids were completely removed within six months with a series of five intradermal injections of autologous dendritic cells.
- The successful use of autologous dendritic cells complements the international scientific community's strategy of combating sarcoids in horses through immunotherapeutic approaches. The literature shows that the immune-evasive microenvironment of sarcoids can be mitigated by non-specific topical immunomodulators such as the herbal creams XXTERRA® and Sarc-off®, which contain bloodroot and zinc chloride, imiquimod (5 %) (Aldara®) and the antiviral cream acyclovir (5 %) or intratumoral injections of Bacillus Calmette-Guérin (BCG) and IL-2. Autologous vaccination with excised and liquid nitrogen-inactivated sarcoid material and recombinant BPV virus-like particles (VLPs), i.e., particles assembled in vitro from BPV capsid protein L1 itself, is more specific but often fails to induce an effective systemic immune response. More recently, live-attenuated influenza A or B viruses with deleted non-structural protein NS1 that co-express inactivated BPV1 E6 and E7 peptides have shown promise in the systemic eradication of BPV 1- and BPV 2-positive cells.^{2, 5}

➤ To conclude: Sarcoids in horses persist as a therapeutic challenge.² They are unpredictable in every respect, including their development, treatment, and recurrence. We, therefore, strongly agree that future evidence-based therapies require the consideration of specific sarcoid lesions in prospective double-blind studies.⁶ ⁵Jindra, C., Hainisch, E.K., Brandt, S., 2023. Immunotherapy of equine sarcoids – From early approaches to innovative vaccines. *Vaccines*, 11, 769. <https://doi.org/10.3390/vaccines11040769>; ⁶Knottenbelt, D.C., 2019. The equine sarcoid: Why are there so many treatment options? *Vet. Clin. N. Am. Equine Pract.*, 35, 243-62. <https://doi.org/10.1016/j.cveq.2019.03.006>