

Case Report

Surgical Treatment of Mammary Melanoma in a Mare: A Case Report

Muhammet Ali Karadağ^{1*} , Merve Sena Demir¹ , Semra Kaya¹ , Celal Şahin Ermutlu² , Emin Karakurt³ 

Duygu Kaya⁴ 

¹ Department of Obstetrics and Gynaecology, Faculty of Veterinary Medicine, Kafkas University, Kars, Türkiye

² Department of Surgery, Faculty of Veterinary Medicine, Kafkas University, Kars, Türkiye

³ Department of Pathology, Faculty of Veterinary Medicine, Kafkas University, Kars, Türkiye

⁴ Department of Obstetrics and Gynaecology, Faculty of Veterinary Medicine, Dokuz Eylül University, İzmir, Türkiye

ABSTRACT

Mammary tumors are exceptionally uncommon in horses, whereas melanomas are frequently observed in gray horses. Limited information is available regarding the treatment options and corresponding success rates for such cases. This case report aims to describe the surgical treatment of a malignant melanoma in a gray mare. A 5-year-old dark gray mare weighing 440 kg was referred to Kafkas University Animal Health Education Research and Practice Hospital due to a slowly growing pigmented mass located in her right peri-mammary region. Detailed clinical examination and lung X-ray did not reveal any specific metastatic findings. Ultrasonography (USG) and Doppler examination showed an oval solid hypoechoic mass with a well-defined hyperechoic margin and limited vascularization. Surgical extraction of the mass was successfully performed under inhalation anesthesia. Histopathological examination of the removed tumoral mass revealed numerous spindles or epithelioid-shaped neoplastic cells containing large brownish-black granular melanin pigments in their cytoplasm, which were widely distributed throughout the mass. This case demonstrates that careful post-operative monitoring can lead to successful outcomes in the surgical management of rare conditions such as mammary gland melanoma/carcinomas in mares. However, further studies are needed to conduct long-term follow-ups of survival rates.

Keywords: Mare, Melanoma, Surgical treatment.

INTRODUCTION

Melanomas are cutaneous tumors originating from pigment-producing melanocytes. In horses, melanomas have a prevalence of 4-15% and are among the most commonly diagnosed tumors in horses with gray hair (1, 2). Although many melanocytic lesions initially appear as slow-growing or benign, a significant number of them develop malignant features over time, increasing local invasiveness and constituting a risk of systemic metastasis (1, 3). Melanoma in horses is a common neoplasm, particularly in older horses with a genetic predisposition resulting from mutations in specific regulatory genes, which creates challenges in tumor treatment planning (4, 5). Although tumor extirpation by surgical excision has long been considered the mainstay of treatment for localized melanoma, it is difficult to obtain complete and oncological safe resection margins in areas with anatomically specific challenges such as the perianal region, tail, and mammary glands, resulting in high local recurrence rates (1, 6).

It is generally accepted that the diagnosis of melanocytic tumors in horses can be established reliably from macroscopic appearance and clinical findings. Reported case studies and retrospective studies show that promising results have been obtained with surgical methods, but they also present some challenges. In one reported case, a mare underwent resection

for an intraocular neuroepithelial tumor followed by evidence of metastatic mammary carcinoma, suggesting that in multifactorial cases, surgical intervention on a tumor at a single anatomical site may sometimes not adequately control recurrences (7). In addition to surgery, innovative techniques provide important complementary approaches to enhance the efficacy of treatment when complete excision is technically challenging. Moreover, the integration of precise imaging modalities such as three-dimensional ultrasonography into preoperative planning has contributed to improved surgical results by ensuring a more accurate definition of tumor margins (6, 8). Although some studies have focused on topical treatments or intratumorally administered chemotherapeutics, surgical intervention remains the primary treatment modality when total resection is possible (2, 9).

In the present case report, the application of the surgical excision approach in treating melanoma in the mammary region of a mare, including the determination of resection margins supported by preoperative planning and modern imaging techniques, as well as post-operative care and follow-up after diagnosis, is considered in detail.

*Corresponding Author: m.ali.krdg@gmail.com

Submitted: 05.06.2025, Accepted: 29.06.2025, Published online: 30.06.2025

How to cite this article: Karadağ MA, Demir MS, Kaya S, Ermutlu CŞ, Karakurt E, Kaya D: Surgical Treatment of Mammary Melanoma in a Mare; A Case Report. Curr Vet Sci, 2(1):22–25, 2025.



This article is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

© 2025, Current Veterinary Science is published by Dokuz Eylül University.

CASE HISTORY

This case summarizes the clinical diagnosis and treatment of a tumorous mass in a 5-year-old, 440 kg, gray-skinned mare that was brought to the Kafkas University Animal Health Education, Research, and Training Hospital and was diagnosed with a pigmented mass in the right mammary region. The anamnesis reported that the mass had started as a small lump over the last 10 months and had grown slowly, but recently reached a size larger than the palm. It was determined that the mare was regularly monitored. Its general condition and feed consumption were normal. There were no issues, such as a decline in body condition or respiratory problems. The mass caused the animal to experience restlessness and anxiety due to its constant contact with its hind limbs and abdominal area, and a decrease in work performance as it was used as a work animal.

Clinical and ultrasonographic examination

In general, clinical examination determined that the patient's overall condition and attentiveness to the environment were normal. The vital signs (respiration, pulse, body temperature) were within physiological limits, and the hair coat was normal. In the detailed clinical examination and thoracic radiography, no specific metastatic findings were observed. Clinical inspection revealed a single solid mass in the right mammary area, larger than the palm, with irregular contours and dense black pigmentation on the surface facing the ground (Figure 1a-b). On palpation, the mass was found to have a hard structure connected to the skin of the right mammary lobe and to penetrate subcutaneously, originating from a specific region. No other mass was found in the region.

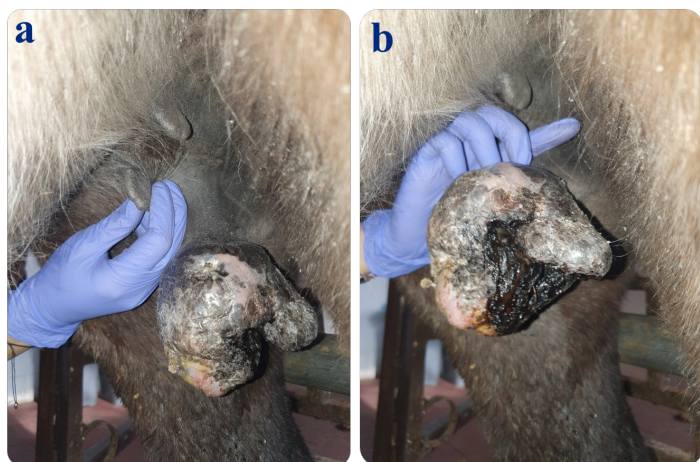


Figure 1: Clinical appearance of an irregular tumoral lesion in the mammary gland (a-b).

Ultrasonographic (USG) and Doppler examination revealed an oval, solid, hypoechoic mass with a well-defined hyperechoic border and poor vascularization (Figure 2).

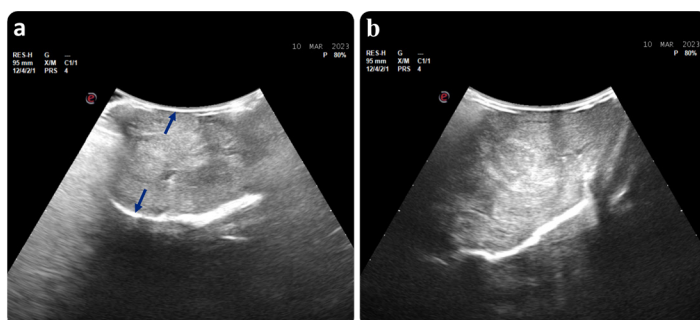


Figure 2: B-mode ultrasonography of the tumoral mass from different directions and hyperechoic capsule (a-b, dark blue arrows).

Surgical treatment

The preoperative clinical examination of the case revealed normal cardiovascular and respiratory values (pulse rate 37 bpm, respiratory rate 12/min). Pre-anesthesia was induced with detomidine hydrochloride (Dormosedan®, 20 µg/kg IV, Zoetis Animal Health, Florham Park, NJ) for about 10 minutes, and the mare was restrained by the Berlin method and placed on the operation mat. After sedation, rapid induction was achieved with ketamine hydrochloride (Ketasol 10%, 2 mg/kg IV, Interhas, VetViva Richter GmbH, Austria) in the pre-induction phase. An endotracheal tube was administered, and general anesthesia was maintained with sevoflurane (Sevoflurane-Baxter, Baxter Healthcare Corp., Puerto Rico, USA) inhalation anesthesia. After standard surgical procedures were performed, the tumor was extirpated by controlled dissection of the mass, whose borders were determined by clinical and USG examinations. Subsequently, the subcutaneous connective tissue was closed using an absorbent suture (PGLA, 0, 2/0 Trusynth Healthium Medtech, India) to minimize tissue gaps. Finally, the operation was completed with a simple continuous suturing technique to preserve the aesthetic and functional integrity of the skin (Figure 3a-b).



Figure 3: Surgical procedure (a-b) and post-operative scar region at 3 months (c, arrowheads).

Meloxicam 0.6 mg/kg, IV (Maxicam, Sonavel Türkiye) was used as an analgesic for post-operative pain management, and 10,000 IU benzyl penicillin procaine/day and 10 mg dihydrostreptomycin/kg, IM (Reptopen, Ceva Animal Health, France) were administered for 5 days for broad-spectrum prophylactic treatment. Nitrofurazone (Furacin 0.2%, Sanofi Türkiye) was applied topically to prevent infection at the incision site. At the end of the three-month clinical follow-up, the patient had recovered with no complications (Figure 3c), and no recurrence was found in the tumor resection area or other parts of the body during the post-operative follow-up period.

Histopathological diagnosis

In the prepared tissue (Figure 4a), the tumoral lesions taken from the mare were fixed in 10% formaldehyde solution, and after routine tissue follow-up procedures, 5-micron-thick sections were prepared from the paraffin blocks obtained, and Hematoxylin & Eosin staining was performed. Neoplastic cells containing intensive, large, brownish-black granular melanin pigments in their cytoplasm were observed spread over a large area of the tumoral mass (Figure 4b). There was a significant nuclear-to-cytoplasmic ratio, heterogeneous nuclei, and sometimes multiple mitotic figures. Furthermore, the band-like arrangement of melanoma cells in the dermis layer was determined to be an essential criterion for confirming the diagnosis and also indicates the tumor's invasive potential and tendency to infiltrate surrounding tissues. Accompanied by these histopathological findings, the diagnosis was confirmed by supporting the classical melanoma histomorphology, and the intensity of melanin pigmentation provided certainty to the diagnosis.

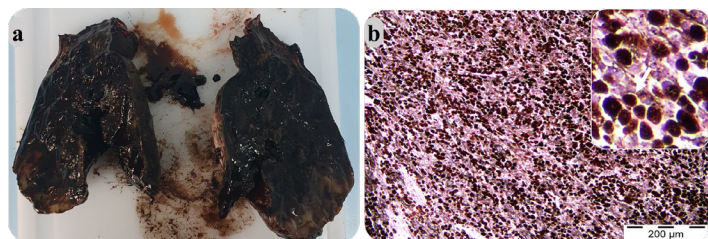


Figure 4: Macroscopic section of the tumor (a), histopathologic observation of neoplastic cells (b, thick white arrow).

DISCUSSION

It was reported that melanocytic tumors constitute 6-15% of all equine cutaneous tumors and 34% of total neoplasms in horses (10). Statistical analyses reveal that there is a marked predisposition to the formation of melanocytic tumors (EMT: Equine Melanocytic Tumors) especially in horses with gray hair (63.27%, $P < 0.01$) and the prevalence of the most malignant EMT types is significantly increased in horses over 15 years of age (70%, $P < 0.05$). These tumors may be benign in the beginning, but data from the literature suggest that all EMTs have the potential to undergo a malignant transformation and even develop distant metastases (11). A black color characterizes EMTs, but (especially high-grade anaplastic melanomas) may range from pale pink to white or marble-like in color. In addition to the more common occurrence of EMT in gray horses, these tumors can also develop in other horses. Typical areas of localization include the ventral side of the tail, perianal region, perineum, external genitalia, parotid gland region, mammary gland, periocular region, and lips (3, 10, 12, 13). The presented case was a gray-brown mare; the anatomical location of the mass and clinical findings were evaluated, resulting in a preliminary diagnosis of melanoma, consistent with the literature information.

Equine melanomas account for approximately 15% of all cutaneous neoplasms; however, their incidence increases sharply in gray hair horses, where progressive hair loss is often accompanied by the gradual appearance of multiple melanocytic masses that grow, coalesce, and sometimes undergo malignant transformation, highlighting the critical need for lifelong dermatologic monitoring and early intervention (14, 15, 16, 17). Although congenital lesions are rare in young horses, melanoma development begins around 6 years of age, when graying of the coat starts, and this risk can be as high as 80% in gray horses over 15 years of age (17, 18, 19). Furthermore, the clinical course of melanoma in horses is slower than in other species, such as humans and dogs, with lower rates of invasion and metastasis (20, 21, 22, 23, 24). Moreover, the effects of the time factor on the clinical course of equine melanomas have been clearly demonstrated. The observed 11.2-fold increase in tumor size over time (25) and an increase in the number of tumors carried by each horse (26) suggest that patients may require more invasive and challenging surgical techniques in the event of late intervention. Accordingly, late intervention results not only in the growth of the current tumor but also in an increased risk of new lesions appearing in the future. Similarly, a review of the clinical course of EMT has demonstrated that early diagnosis and surgical excision significantly reduce the risk of progressive invasive complications and distant metastasis by preventing an increase in tumor size and tumor number. Surgical excision of tumors located in the perianal, perirectal, and ventral surface of the tail has been reported to be locally curative, and recurrence has been emphasized to be minimal (6, 27). Furthermore, the simultaneous presence of two rare tumors affecting the eye and mammary gland, intraocular neuroepithelial neoplasm and metastatic mammary carcinoma, which are diagnosed in horses in a short period (e.g. within 9 months), reveals the vital importance of early intervention

and points out that post mortem and immunohistochemical (IHC) evaluations provide diagnostic certainty (6, 7, 28).

In the presented case, the pigmented mass, initially appearing as a small lump in the right mammary region, developed significantly over time, causing the animal to become restless and negatively affecting its work performance. In the light of clinical, ultrasonographic, and Doppler examinations, the lesion was demarcated and its malignant potential was considered low. The surgical operation was performed meticulously following standard procedures from preoperative preparations to anesthesia administration, from controlled dissection to at least 2 cm additional removal of surrounding tissue, and this approach is in line with the treatment options reported by Groom and Sullins (6), where systemic effects are rarely observed and local control is achieved.

Veterinary pathologists have had difficulty accurately predicting the biological behavior of EMT using existing classification systems for many years; therefore, the combined evaluation of clinical staging and histopathological classification has become indispensable in providing prognostic information (10, 13, 19, 25, 29, 30, 31). Histopathologic examination of the tissue samples, stained with hematoxylin and eosin, revealed the classic features of the tumor tissue, including intense melanin pigmentation, spindle or epithelioid cellular morphology, a high nuclear-to-cytoplasmic ratio, and a band-like cellular distribution. These findings confirm the invasive potential of the tumor and its tendency to infiltrate surrounding tissues, which are critical in clarifying the diagnosis and determining prognosis (32).

In the presented case, early surgical treatment, USG-guided excision of the tumor within clearly defined surgical margins, and careful management of appropriate anesthesia and post-operative care protocols resulted in a significant improvement in the patient's clinical prognosis. No recurrence was observed at the excision site during the three-month follow-up period. Histopathological evaluations confirmed the classical melanoma features of the tumor, demonstrating its invasive potential and indicating that early intervention is successful in these neoplasms. These results, which are in line with the literature data, support that the progressive complications of equine melanomas and the need for invasive surgery can be minimized with timely and correctly planned intervention. Thus, by providing reliable, evidence-based advice to horse owners, veterinarians can take important steps in preserving patients' quality of life and working performance through early diagnosis and surgical excision (6, 25, 26, 27, 33).

It is believed that melanoma cases can be effectively controlled through a surgical approach, and the difficulties and recurrence rates reported in the current literature can be reduced with the use of appropriate techniques and a multidisciplinary methodology. However, long-term follow-up is required to determine survival rates.

DECLARATIONS

Authors' Contributions: The operative procedure was performed under the management of DK, SK, and CŞE. MSK managed the post-operative clinical follow-up, and EK made a histopathological diagnosis. DK and MAK prepared and wrote the manuscript.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this manuscript.

Ethical Statement: Informed consent was obtained from the patient's owner for this case report.

Generative Artificial Intelligence Statement: The authors of this manuscript declare that no artificial intelligence was used in any part of the manuscript, including both text and figures.

Funding Support: There is no funding support.

REFERENCES

- Johnson PJ: Dermatologic Tumors (Excluding Sarcoids). *Vet Clin North Am: Equine Pract*, 14: 625-658, 1998. [https://doi.org/10.1016/S0749-0739\(17\)30190-6](https://doi.org/10.1016/S0749-0739(17)30190-6)
- Weber LA, Delarocque J, Feige K, Kietzmann M, Kalbitz J, Meißner J, Paschke R, Cavalleri JM: Effects of Topically Applied Betulinic Acid and NVX-207 on Melanocytic Tumors in 18 Horses. *Animals*, 11: 3250, 2021. <https://doi.org/10.3390/ani11113250>
- Valentine BA: Equine Melanocytic Tumors: A Retrospective Study. *J Vet Intern Med*, 9: 291-297, 1995. <https://doi.org/10.1111/j.1939-1676.1995.tb01087.x>
- Pielberg GR, Golovko A, Sundström E, Curik I, et al: A cis-acting regulatory mutation causes premature hair graying and susceptibility to melanoma in the horse. *Nat Genet*, 40: 1004-1009, 2008. <https://doi.org/10.1038/ng.185>
- Sundström E, Imsland F, Mikko S, Wade C, et al: Copy number expansion of the STX17 duplication in melanoma tissue from grey horses. *BMC Genomics*, 13: 365, 2012. <https://doi.org/10.1186/1471-2164-13-365>
- Groom LM, Sullins KE: Surgical excision of large melanocytic tumours in grey horses: 38 cases (2001–2013). *Equine Vet Educ*, 30: 438-443, 2018. <https://doi.org/10.1111/eve.12767>
- Brocca G, Centelleghé C, Padoan E, Stoppini R, Giudice C, Castagnaro M, Zappulli V: Case Report of a Mare Diagnosed with a Metastatic Mammary Carcinoma after the Excision of a Recurrent Intraocular Neuroepithelial Tumor. *Animals*, 10: 2409, 2020. <https://doi.org/10.3390/ani10122409>
- Faustino-Rocha A, Oliveira PA, Pinho-Oliveira J, et al: Estimation of rat mammary tumor volume using caliper and ultrasonography measurements. *Lab Anim*, 42: 217-224, 2013. <https://doi.org/10.1038/labon.254>
- Jeong H, Kwon YS: Topical Chemotherapy Using Cisplatin for Treatment of Malignant Melanoma in a Grey Horse. *Pak Vet J*, 40 (1): 130-132, 2019. DOI: 10.29261/pakvetj/2019.072
- Knottenbelt DC: Melanocytic neoplasms. In: Patterson-Kane JC, Snalune KL (Eds): *Clinical Equine Oncology*. 237-245, Elsevier Health Sciences, UK, 2015.
- Malá A, Kopecká A, Jahn P, Linhart P, Frgelecová L, Škorič M: Prevalence and histopathological classification of equine melanocytic tumours in the Czech Republic and Slovakia. *Acta Vet Brno*, 93 (3): 269-274, 2024. <https://doi.org/10.2754/avb202493030269>
- Fleury C, Bérard F, Balme B, Thomas L: The study of cutaneous melanomas in Camargue-type gray-skinned horses (1): clinical-pathological characterization. *Pigment Cell Res*, 13: 39-46, 2000. <https://doi.org/10.1034/j.1600-0749.2000.130108.x>
- MacGillivray K, Sweeney R, Del Piero F: Metastatic melanoma in horses. *J Vet Intern Med*, 16: 452-456, 2002. <https://doi.org/10.1111/j.1939-1676.2002.tb01264.x>
- Rosengren Pielberg G, Golovko A, Sundström E, Curik I, Lennartsson J, Seltenhammer MH, Druml T, Binns M, Fitzsimmons C, Lindgren G, Sandberg K, Baumung R, Vetterlein M, Strömberg S, Grabherr M, Wade C, Lindbald-Toh K, Pontén F, Heldin CH, Sölkner J, Andersson L: A cis-acting regulatory mutation causes premature hair graying and susceptibility to melanoma in the horse. *Nat Genet*, 40: 1004-1009, 2008. <https://doi.org/10.1038/ng.185>
- Curik I, Druml T, Seltenhammer M, Sundström E, Pielberg GR, Andersson L, Sölkner J: Complex Inheritance of Melanoma and Pigmentation of Coat and Skin in Grey Horses. *PLoS Genet*, 9: e1003248, 2013. <https://doi.org/10.1371/journal.pgen.1003248>
- Teixeira RBC, Rendahl AK, Anderson SM, Mickelson JR, Sigler D, Buchanan BR, Coleman RJ, McCue ME: Coat Color Genotypes and Risk and Severity of Melanoma in Gray Quarter Horses. *J Vet Intern Med*, 27: 1201-1208, 2013. <https://doi.org/10.1111/jvim.12133>
- Cavalleri JM, Mählmann K, Steinig P, Feige K: Aetiology, Clinical Presentation and Current Treatment Options of Equine Malignant Melanoma—A Review of the Literature. *Pferdeheilkunde*, 30: 455-460, 2014.
- Foley G, Valentine B, Kincaid A: Congenital and Acquired Melanocytomas (Benign Melanomas) in Eighteen Young Horses. *Vet Pathol*, 28: 363-369, 1991. <https://doi.org/10.1177/030098589102800503>
- Pimenta J, Prada J, Cotovio M: Equine melanocytic tumors: A narrative review. *Animals*, 13: 247, 2023. <https://doi.org/10.3390/ani13020247>
- Seltenhammer MH, Heere-Ress E, Brandt S, Druml T, Jansen B, Pehamberger H, Niebauer GW: Comparative Histopathology of Grey-Horse-Melanoma and Human Malignant Melanoma. *Pigment Cell Res*, 17: 674-681, 2004. <https://doi.org/10.1111/j.1600-0749.2004.00192.x>
- Resende L, Moreira J, Prada J, Queiroga FL, Pires I: Current Insights into Canine Cutaneous Melanocytic Tumours Diagnosis. In: *Melanoma—Current Clinical Management and Future Therapeutics*. Intech, Rijeka, Croatia, 2015. <https://doi.org/10.5772/59480>
- Nishiya AT, Massoco CO, Felizzola CR, Perlmann E, Batschinski K, Tedardi MV, Garcia JS, Mendonça PP, Teixeira TF, Dagli MLZ: Comparative Aspects of Canine Melanoma. *Vet Sci*, 3: 7, 2016. <https://doi.org/10.3390/vetsci3010007>
- Wong K, van derWeyden L, Schott CR, Foote A, Constantino-Casas F, Smith S, Dobson JM, Murchison EP, Wu H, Yeh I, et al: Cross-Species Genomic Landscape Comparison of Human Mucosal Melanoma with Canine Oral and Equine Melanoma. *Nat Commun*, 10: 353, 2019. <https://doi.org/10.1038/s41467-018-08081-1>
- Deleon M: Cutaneous Melanoma: A Comparative Study between Gray Horses, Canines, and Humans. Iowa State Univ, Ames, IA, USA, 2021.
- Moore JS, Shaw C, Shaw E, Buechner-Maxwell V, Scarratt WK, Crisman M, Furr J, Robertson J: Melanoma in horses: Current perspectives. *Equine Vet Educ*, 25:3 144-151, 2013. <https://doi.org/10.1111/j.2042-3292.2011.00368.x>
- Knottenbelt DC: The equine melanoma. *Equine Health*, 40: 23-26, 2018. <https://doi.org/10.12968/eqhe.2018.40.23>
- Rowe EL, Sullins KE: Excision as treatment of dermal melanomatosis in horses: 11 cases (1994–2000). *J Am Vet Med Assoc*, 225: 94-96, 2004. <https://doi.org/10.2460/javma.2004.225.94>
- MacEachern KE, McKay JS, Hewicker-Trautwein M: Malignant mammary melanoma in a young mature thoroughbred mare. *Equine Vet Educ*, 13 (2): 68-71, 2001. <https://doi.org/10.1111/j.2042-3292.2001.tb01888.x>
- Metcalfe LV, O'Brien PJ, Papakonstantinou S, Cahalan SD, McAllister H, Duggan VE: Malignant melanoma in a grey horse: case presentation and review of equine melanoma treatment options. *Ir Vet J*, 66: 22, 2013. <https://doi.org/10.1186/2046-0481-66-22>
- Sullins KE: Melanocytic Tumours in Horses. *Equine Vet Educ*, 32: 624-630, 2020. <https://doi.org/10.1111/eve.13159>
- Seltenhammer MH, Simhofer H, Scherzer S, Zechner R, Curik I, Sölkner J, Brandt SM, Jansen B, Pehamberger H, Eisenmenger E: Equine melanoma in a population of 296 grey Lipizzaner horses. *Equine Vet J*, 35: 153-157, 2003. <https://doi.org/10.2746/042516403776114234>
- Billi T, Karadima V, Tyrnenopoulou P, Apostolopoulou EP, Brellou GD, Diakakis N: Surgical excision of a malignant metastatic melanoma located in a skeletal muscle of the lateral thorax of a horse. *Vet Med Sci*, 7 (2): 297-302, 2021. <https://doi.org/10.1002/vms3.366>
- Pimenta J, Prada J, Pires I, Cotovio M: The Impact of Excision Interval on Equine Melanoma Progression: Time Matters? *Animals*, 14 (8): 1244, 2024. <https://doi.org/10.3390/ani14081244>