

## *Anaplastic malignant melanoma of the tail in non-grey horses*

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1 Anaplastic malignant melanoma of the tail in non-grey horses

2

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17 **Keywords:** horse; malignant melanoma; neoplasia

18 **Summary**

19 Information regarding signalment, clinical findings, treatment, and outcome of 5 previously reported  
20 cases of anaplastic malignant melanoma of the tail in non-grey horses and of 5 additional cases are  
21 summarized. Age was recorded for 9 horses and mean age was 16 years, range 8 to 23 years. Gender  
22 was recorded for 8 horses and 6 of these 8 horses were male horses over 14 years of age. The most  
23 common coat colour was bay (6 horses). Other coat colours were palomino (1 horse), chestnut (1 horse),  
24 and black (1 horse); coat colour of 1 non-grey horse was not specified. Follow up information was  
25 available for 9 horses and only 1 horse, a palomino, survived more than 10 months following diagnosis  
26 and tail amputation. Surgical excision, including tail amputation and medical therapy with oral  
27 cimetidine, was not effective in non-grey, non-palomino horses. Tumour recurred on tail tissue  
28 remaining after amputation in 2 horses, widespread metastases were documented in 4 cases, and  
29 metastasis was suspected at the time of death or euthanasia in 3 cases, including 1 case with  
30 amputation site regrowth. No subjective histopathologic differences were detected in the palomino that  
31 survived as compared to horses of other coat colours. Findings suggest that anaplastic malignant  
32 melanoma of the tail in bay, chestnut, and black horses is most often a very aggressive neoplasm, but  
33 that there are rare exceptions.

## 34 **Introduction**

35 Melanocytic tumors in horses are well-documented (Foley *et al.* 1991; MacGillivray *et al.* 2002; Moore *et*  
36 *al.* 2013; Schöniger and Summers 2009; Valentine 1995), although still not completely understood.

37 Types of melanocytic neoplasms in horses are described as grey horse dermal melanoma, grey horse  
38 dermal melanomatosis, melanocytoma (melanocytic naevus), and anaplastic malignant melanoma  
39 (Valentine 1995).

40 Melanocytic tumours are most common in horses with a grey coat colour (MacGillivray *et al.* 2002;  
41 Moore *et al.* 2013; Valentine 1995), but occurrence in horses of other coat colours is possible (Floyd  
42 2003; Foley *et al.* 1991; Honnas *et al.* 1990; Kunze *et al.* 1986; LeRoy *et al.* 2005; Mostafa 1953; Pascoe  
43 and Summers 1981; Poore *et al.* 2013; Tyler and Fox 2003; Valentine 1995). Benign melanocytic tumours  
44 known as melanocytoma or melanocytic nevus are the most common type of melanocytic tumour to  
45 arise in non-grey horses (Foley *et al.* 1991, Valentine 1995), but anaplastic malignant melanoma also  
46 occurs in non-grey horses (Floyd 2003; Foley *et al.* 1991; Honnas *et al.* 1990; Kunze *et al.* 1986; LeRoy *et*  
47 *al.* 2005; Mostafa 1953; Pascoe and Summers 1981; Poore *et al.* 2013; Tyler and Fox 2003; Valentine  
48 1995).

49         Diagnosis of melanocytic neoplasia in poorly pigmented melanocytic neoplasms in non-grey  
50 horses can be challenging and relies on histopathologic or cytologic examination of tumour cells. Once a  
51 diagnosis of melanocytic neoplasia has been made in a non-grey horse it is vitally important to  
52 distinguish between melanocytoma, a benign neoplasm (Foley *et al.* 1991; Valentine 1995), and  
53 anaplastic malignant melanoma, which is typically very aggressive (Floyd 2003; Honnas *et al.* 1990;  
54 Kunze *et al.* 1986; LeRoy *et al.* 2005; Mostafa 1953; Pascoe and Summers 1981; Poore *et al.* 2013; Tyler  
55 and Fox 2003; Valentine 1995). Information regarding prognosis of different equine melanocytic  
56 tumours is very important when making decisions regarding therapy. The potential for malignancy,  
57 manifesting as metastatic tumours, has been documented in melanomas occurring in grey horses

58 (MacGillivray *et al.* 2002; Moore *et al.* 2013; Valentine 1995). But, in many cases, surgical excision of  
59 grey horse dermal melanoma is curative (Valentine 1995), as is surgical excision of melanocytoma in  
60 grey and non-grey horses (Foley *et al.* 1991). There is a growing body of literature related to aggressive  
61 behavior of anaplastic malignant melanoma in non-grey horses (Floyd 2003; Honnas *et al.* 1990; Kunze  
62 *et al.* 1986; LeRoy *et al.* 2005; Mostafa 1953; Pascoe and Summers 1981; Poore *et al.* 2013; Tyler and  
63 Fox 2003; Valentine 1995). Location of reported cases of anaplastic malignant melanoma in non-grey  
64 horses varies, including 3 cases involving hoof wall or coronary band in chestnut, bay, and Paint horses  
65 (Floyd 2003; Honnas *et al.* 1990; Kunze *et al.* 1986) and 1 case in the nasopharynx of a dark brown horse  
66 (Tyler and Fox 2003). Five reported cases of anaplastic malignant melanoma in non-grey horses occurred  
67 in skin of the tail (LeRoy *et al.* 2005; Mostafa 1953; Pascoe and Summers 1981; Poore *et al.* 2013;  
68 Valentine 1995) suggesting that this may be a common site for anaplastic malignant melanoma in non-  
69 grey horses. This report summarizes the literature regarding anaplastic malignant melanoma of the tail  
70 in non-grey horses and describes 5 additional cases.

71

## 72 **Cases**

73 Cases of malignant melanoma of the tail of non-grey horses confirmed by histopathologic examination  
74 were collected by the first author over a period of 25 years, and the literature regarding malignant  
75 melanoma in non-grey horses was reviewed. Five previously reported cases and 5 additional cases are  
76 summarized in **Table 1**.

77

## 78 ***Signalment and clinical history***

79 Age was recorded for 9 cases, and the mean age of affected horses was 16 years, range 8 to 23 years.  
80 The most common coat colour was bay (6 cases). Other coat colours were palomino (1 case), chestnut (1  
81 case), and black (1 case). The only information available for 1 horse was that it was non-grey. Males

82 were most commonly affected (1 stallion, 5 geldings), with 2 affected mares. Gender of 2 horses was not  
83 reported. Locations within the tail were described as ventrum (5 cases), lateral (2 cases), dorsum (1  
84 case), mid-tail (1 case) and end of the tail (1 case). Tumours on the tail were most often single tumours  
85 (8 cases). Case 1 had multiple tail tumours and case 9 had 2 tail tumours. Tumours were typically  
86 multilobular, white, pale tan, grey, black or dark brown in colour (**Fig 1 and 2**), and had a smooth (cases  
87 1, 6, and 7) to ulcerated (cases 4, 8, and 9) skin surface. The tumour in case 5 progressed from being  
88 smooth surfaced to having an ulcerated surface 2 weeks later. The gross appearance of 3 tumours was  
89 not described. The tail was the only reported site of cutaneous mass lesions in 8 horses; case 1 also had  
90 perianal masses and case 4 had multiple similar nodules affecting skin of the face and of the shoulder.

91

#### 92 ***Treatment and outcome***

93 Tail amputation was the most common treatment and was performed in 5 horses (cases 2, 5, 7, 8, and  
94 10). Oral cimetidine was given to 2 horses at a dosage of 2.5 mg/kg bwt *per os* t.i.d. for an unknown  
95 length of time (case 4) and 48 mg/kg bwt *per os* once daily for 3 days (case 9). No therapy was  
96 attempted in case 1, and details of therapy were not available for 2 horses (cases 3 and 6). Follow up  
97 was available for 9 horses, and all but the palomino mare (case 7) had died or been euthanized due to  
98 tumour complications from 1 day to 10 months following diagnosis of anaplastic malignant melanoma.  
99 Tumour recurred on remaining tail tissue following amputation in 2 horses (cases 5 and 8), widespread  
100 metastases were documented in 4 horses (cases 1, 3, 9, and 10), and metastasis was suspected in 3  
101 horses (cases 2, 4, and 8). Sites of metastasis were not always described, but reported metastatic sites  
102 were thigh muscle, spleen, lung, peritoneum, mesenteric lymph node, liver, kidney, and bone marrow  
103 (Mostafa 1953), and spleen, lung, and thigh muscle in case 9. Case 7 is still alive at the time of this  
104 writing, 5.5 years after diagnosis of anaplastic malignant melanoma of the tail followed by tail  
105 amputation.

106

107 ***Histopathologic findings***

108 Samples of all tail masses were diagnosed as anaplastic malignant melanoma based on histopathologic  
109 evidence of marked cellular and nuclear pleomorphism, mitotic activity (up to 6 mitoses per high power  
110 field), varying amounts of intracytoplasmic melanin (generally sparse), tumour necrosis, and epithelial,  
111 local, or lymphatic invasion. No subjective difference in histopathologic findings was detected in the  
112 tumour from the palomino horse that survived at least 5.5 years compared to other non-grey horses  
113 that died within 10 months of diagnosis (**Fig 3 and Fig 4**).

114

115 **Discussion**

116 Results of this study indicate that anaplastic malignant melanoma in non-grey horses often occurs on  
117 the tail and that, with rare exceptions, it is an aggressive tumour leading to death within a year of  
118 diagnosis. Surgical excision, including tail amputation, and medical therapy (cimetidine) do not appear to  
119 be effective in most cases of anaplastic malignant melanoma of the tail in non-grey horses. The 1 case in  
120 which the tumour did not have an aggressive behavior was a palomino mare. Interestingly, this was also  
121 the youngest horse in the study (8 years old at the time of diagnosis). Additional case studies of  
122 anaplastic melanoma of the tail in non-grey horses will be important to improve the ability to predict  
123 behavior and to treat these tumours.

124

125 **Authors' declarations of interests**

126 No conflicts of interest have been declared.

127

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157 **Table 1: Summary of 5 previously reported and 5 new cases of malignant melanoma of the tail in non-**  
 158 **grey horses.**

159

Case No.	Breed	Colour	Age (yrs)	Gender	Site on tail	Treatment	Follow Up
1 <sup>a</sup>	Arabian	Bay	15	Stallion	Ventrum	None	Died in 1 day with metastatic disease
2 <sup>b</sup>	Unknown	Non-grey	Unknown	Unknown	Middle	Amputation	Died 6 months post-surgery, no necropsy
3 <sup>c</sup>	Morgan	Chestnut	23	Gelding	End	Unknown	Died in 10 months with metastatic disease
4 <sup>d</sup>	Thoroughbred	Bay	14	Gelding	Ventrum	Cimetidine	Suspected metastatic disease at time of diagnosis
5 <sup>e</sup>	Irish Draught	Bay	16	Gelding	Lateral	Amputation	Regrowth at surgical site at 9 months
6	Morgan	Bay	20	Unknown	Lateral	Unknown	Unknown
7	Quarter horse	Palomino	8	Mare	Ventrum	Amputation	Alive and well

---

							5.5 years post-surgery
8	Peruvian Paso	Bay	18	Gelding	Dorsum	Amputation	Euthanized 8 months post-amputation with regrowth at surgical site and suspected metastatic disease
9	Crossbred	Bay	20	Gelding	Ventrum	Cimetidine	Euthanized at 7 months with metastatic disease
10	Friesian	Black	12	Mare	Ventrum	Amputation	Died at 9 months post-surgery with metastatic disease

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160

161

162 <sup>a</sup> Mostafa 1953

163 <sup>b</sup> Pascoe and Summers 1981

164 <sup>c</sup> Valentine 1995

165 <sup>d</sup> LeRoy *et al.* 2005

166 <sup>e</sup> Poore *et al.* 2013

167

168 **Figure Legends**

169 Fig 1: Amputated tail from case 8, an 18-year-old bay Peruvian paso gelding. There is a multilobular  
170 extensively ulcerated black pigmented mass within the skin. Image courtesy of Dr. Ed Scott and Dr. Jason  
171 Errico, Oregon State University College of Veterinary Medicine.

172  
173 Fig 2: Section of the tail mass from case 9, a 20-year-old bay mixed breed gelding. The mass is fleshy,  
174 pale tan, and multilobular. Image courtesy of Dr. Carol A. Lichtensteiger, University of Illinois College of  
175 Veterinary Medicine.

176  
177 Fig 3: Photomicrograph from the anaplastic malignant melanoma on the tail of case 7, an 8-year-old  
178 palomino Quarter horse mare that survived at least 5.5 years following diagnosis and tail amputation.  
179 Beneath the epidermis (E) there is a poorly defined tumour composed of sheets of plump and  
180 pleomorphic epithelioid cells. There is no discernible intracytoplasmic melanin in this field. Mitoses are  
181 frequent (arrows). Haematoxylin and eosin. Bar = 25  $\mu$ m.

182  
183 Fig 4: Photomicrograph from the anaplastic malignant melanoma on the tail of case 8, an 18-year-old  
184 bay Peruvian paso gelding that was euthanized 8 months following diagnosis and tail amputation due to  
185 local tumour regrowth and suspect internal metastases. Beneath the epidermis (E) there is a poorly  
186 defined tumour composed of sheets and small nests of plump and pleomorphic epithelioid cells. Mitoses  
187 are present (arrows) and 1 cell containing melanin pigment is present (arrowhead). Haematoxylin and  
188 eosin. Bar = 25  $\mu$ m.

189