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Melanocytic masses on the tail of three non-grey horses – imaging, histopathology and tail amputation as surgical treatment

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Summary: This case series describes three horses presented with masses in the mid and distal tail region. Cytology, histopathology and radiography identified the masses as dermal melanoma and amelanotic melanoma. In all three horses, tail amputation was performed successfully in the standing horse with sedation and an epidural anaesthesia. Two horses diagnosed with an amelanotic melanoma, showed recurrence 2 and 5 months after surgery and were euthanised. The other horse showed no recurrence six months after tail amputation. The horse was performing at previous performance level and showed no complaints of increased insect harassment. This case series describes three non-grey horses with melanocytic masses on the tail, with an amelanotic melanoma carrying a poor prognosis.

Keywords: coccygeal vertebrae, histopathology, horse, melanoma, tumour

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Introduction

Masses on the tail of the horse can be of different nature, e.g. neoplastic or inflammatory. Melanocytic tumours are known to be common in grey horses and can be located on the different locations of the tail [1–3]. However, in both grey and non-grey horses it is important to realise that other types of lesions can also occur. Achieving a diagnosis of the mass is important in order to select the best treatment option and to determine the prognosis.

In cases where extensive surgical excision is considered a valid treatment option, tail amputation can be performed if the masses are located in the mid or distal tail region. A surgical technique for tail amputation has been described previously for different clinical indications [4,5]. Other indications to perform tail amputation could be trauma such as a coccygeal luxation or tail docking as performed in certain breeds [6–8].

This case series describes the clinical features and outcomes of three non-grey horses (chestnut, cremello, bay) with masses in the mid-and distal tail region considered to be a men able to surgical excision as well as the histopathological descriptions of the masses. It also describes the technique of surgical tail amputation in the standing horse.

Case descriptions

Case details

Three horses were referred to the Department of Clinical Sciences, Equine Surgery of Utrecht University for further diagnostics and surgical treatment because of progressive masses on the tail. Patient history, clinical examinations, additional diagnostics, surgical procedure and treatment were recorded.

Case 1

A 17-year-old chestnut Dutch Warmblood gelding presented with two large ulcerating masses on the mid-tail region. One with a diameter of 7 cm, the second smaller lesion had a diameter of 2 cm (Fig. 1A). The masses were present for 10 years, however the owner noticed a sudden increase in size. There was some degree of discharge but otherwise the horse was functioning well according to the owner. No abnormalities were found on general clinical examination. On rectal examination a mass measuring 2 to 4 cm was palpated at a depth of 30 cm in the rectal wall, protruding into the rectal lumen. Fine needle aspirates were taken of the lesions on the tail, showing dark pigmented cells suggesting a melanocytic mass.

Case 2

A 18-year-old cremello Pura Raza Española stallion presented with a mass of 5 cm in diameter in the distal part of the tail with serohemorrhagic discharge (Fig. 1B). The mass was first noticed by the owner 2 months earlier, at that time already showing discharge. The horse had no other complaints according to the owner. On general clinical examination no other abnormalities were found and four punch biopsies were taken. Histopathology suggested a trichoblastoma with a neoplasm of melanocytic origin as differential.

Case 3

A 18-year-old bay Dutch Warmblood gelding presented with a 7 to 10 cm mass in the mid-tail region with purulent discharge (Fig. 1C and 1D). Changes of the tail were noticed since 3 weeks. The referring veterinarian took a biopsy of the mass, showing an undifferentiated anaplastic neoplasia on histopathology. On clinical examination, the tail had an increased range of motion and was painful on palpation. A radiographic examination of the tail was performed. A severe, very irregular marginated space-occupying increase in soft tissue was seen at the level of the fifth to seventh coccygeal vertebrae counted from the most caudal aspect, mainly protruding outwards on the left lateral aspect of the tail. A clear irregular increase in soft tissue opacity was also seen together with debris in the tail hairs along the lesion. The sixth coccygeal vertebra was almost completely absent due to severe permeative osteolysis, only the cranial and caudal vertebral endplates were still visible. The adjacent vertebrae did not seem to be involved, however a small step in alignment could be noted with the caudal part of the tail being positioned more ventral. (Fig. 2A and 2B).

Surgical treatment

Tail amputation was advised in all horses. Premedication consisted of detomidine hydrochloride (Domosedan[a] 0.01 mg/kg bwt intravenously (i.v.)) and morphine hydrochloride (Morfine[b] 0.1–0.2 mg/kg bwt i.v.). The horses also received pre-operative benzylpenicillin (Benzylpenicilline Natrium[c] 20.000IE/kg bwt i.v.), gentamycin (Gentamycine 5 %[d] 6,6 mg/kg bwt i.v.) and meloxicam (Metacam[e] 0.6 mg/kg bwt i.v.) or flunixin meglumine (Cronyxin[f] 1.1 mg/kg bwt i.v.) via a catheter placed in the jugular vein. Epidural anesthesia was performed using a 20 Gauge (G) 75 mm long spinal needle (Spinocan[g]) and levobupivacaine (Chirocaïne[h] 2,5 mg/ml, 5–8 ml) or mepivacaine (Mepidor[i] 20 mg/ml, 5–8 ml) depending on the estimated surgical time. One horse (case 1) received an epidural catheter (Perifix[i] 402 filter set, 19 G) through which the local anesthetic was administered. The epidural catheter in this horse was placed in order to administer morphine postoperatively if needed. A continuous-rate infusion with detomidine hydrochloride (Domosedan[a] 0.01 mg/kg bwt), based on sedative clinical effect was administered during the entire

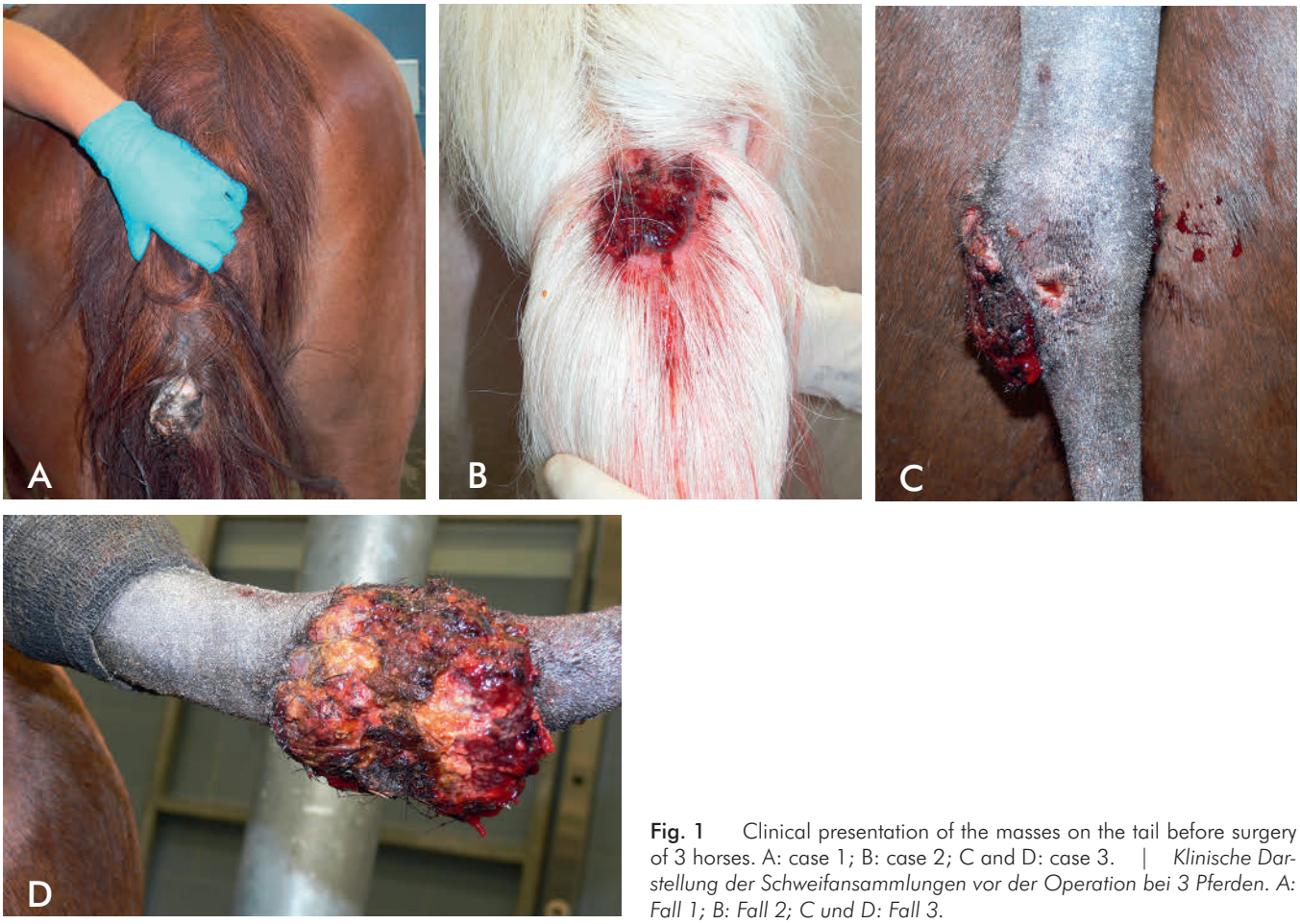

Fig. 1 Clinical presentation of the masses on the tail before surgery of 3 horses. A: case 1; B: case 2; C and D: case 3. | *Klinische Darstellung der Schweifansammlungen vor der Operation bei 3 Pferden. A: Fall 1; B: Fall 2; C und D: Fall 3.*

procedure through the jugular vein catheter (Intraflon 14 G × 80 mm).

In preparation of the surgical site, hairs in the proximal region were reflected and only the surgical site was clipped. Therefore horses would still be able to use the tail for removal of insects directly after surgery. A tourniquet (Midmark large animal blood pressure cuff size 8 for Cardell monitors[m]) was placed proximal to the surgical site and inflated to a value above arterial pressure. After aseptic preparation, the location of disarticulation was determined by careful palpation and passive movement of the tail and by placement of an 18-Gauge needle in the selected intercoccygeal space (Fig. 3A). A curvilinear incision using a scalpel blade 22 was made on the dorsal and ventral side of the tail just distal to the site of the proposed disarticulation (Fig. 3B). After reflection of the created U-shaped skin flaps, the disarticulation was performed using the scalpel. In one horse (case 2) the site of transection was at the level of a coccygeal vertebra instead of the intercoccygeal space. Obstetric wire was used to create the dissection plane through the coccygeal vertebral body. Visible vessels were ligated using absorbable multifilament suture material (polyglactin 910 3 or 3.5 metric[o]), the most important being the branches of the coccygeal vein and artery on the ventral, lateral and dorsal side of coccygeal vertebrae (*Zietzschmann* et al.[9]). The pressure from the tourniquet was released in order to assess the quality of the obtained haemostasis. Apposition of the skin flaps was performed by two rows of interrupted tension suture patterns (far-near-near-far or a horizontal mattress) with non-absorbable monofilament suture material (polypropylene 4.0 metric[n]). Procaine benzylpenicillin (Procapen[k] 20 mg/kg bwt intramuscular (i.m.)) was administered at the end of the procedure.

Post-operative treatment, histopathology and outcome

For histopathological evaluation, tissue samples were fixed in 10 % neutral-buffered formalin and subsequently paraffin-embedded. Tissue sections of 4 µm were stained with haematoxylin and eosin (H&E) and a diagnosed by board-certified veterinary pathologists.

Case 1

Morphine was administered (Morfine[b] 0.1–0.2 mg/kg bwt, 10 ml) through an epidural catheter 2 hours after the surgery, after which this catheter was removed. The horse showed mild signs of colic post-operatively due to mild obstipation of the ascending colon. The horse recovered after medical treatment consisting of nasogastric intubation with paraffin oil and scopolamine-butylbromide (Buscopan[l] 0,3 mg/kg btw i.v.). Meloxicam (Metacam[e] 0,6 mg/kg btw p.o. (orally)) once daily was administered for 3 consecutive days. Ten days post-operatively the horse was discharged without any complaints in wound healing.

No post-operative histopathology was performed in this case. No recurrence of the masses was recorded up to 6 months post-operatively.

Case 2

The horse received meloxicam (Metacam[e] 0,6 mg/kg btw p.o. (orally)) once daily for four days post-operatively. Seven days after surgery the horse was discharged and there were no complaints in wound healing

The post-operative biopsies taken from case 2 all showed a generally similar histologic pattern of cords and nests of epithelioid cells with mild cellular and nuclear pleomorphism, moderate numbers of mitotic figures and an infiltrative growth pattern (Fig. 4A). Only a small percentage of the neoplastic cells contained a moderate amount of melanin pigment, most cells were amelanotic. Because epithelial tumours can contain melanin pigment, immunohistochemistry (IHC) was performed with an antibody against cytokeratins (clone AE1/AE3) and an antibody against S100 using appropriate positive and negative controls. Since the neoplastic cells were positive for S100 (Fig. 4D) and negative for cytokeratin, the neoplasm was eventually diagnosed as a (largely amelanotic) melanoma. The excision margins were considered free of neoplastic cells.

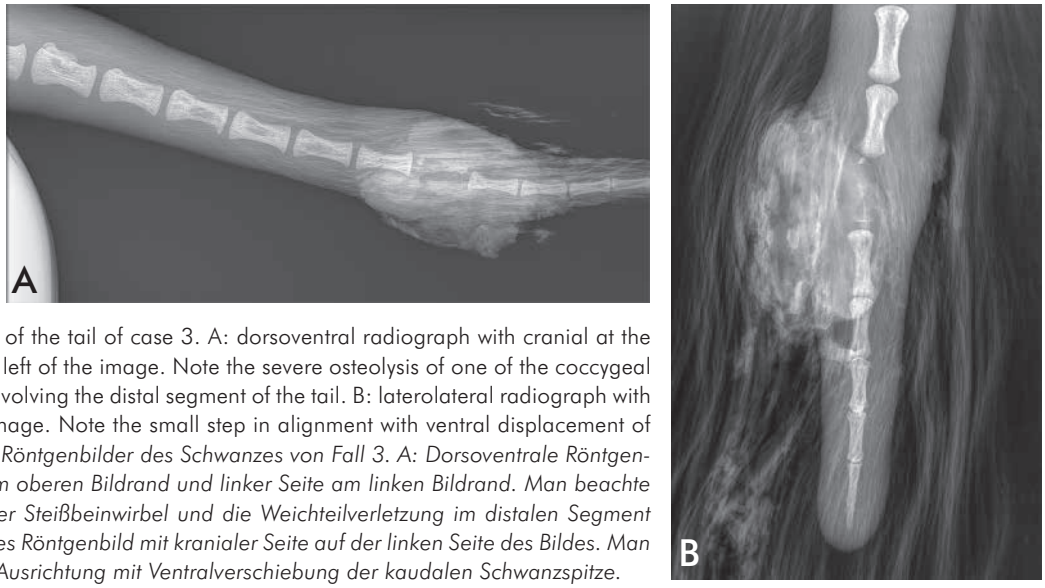

Fig. 2 Radiographic images of the tail of case 3. A: dorsoventral radiograph with cranial at the top of the image and left at the left of the image. Note the severe osteolysis of one of the coccygeal vertebra and soft tissue lesion involving the distal segment of the tail. B: laterolateral radiograph with cranial on the left side of the image. Note the small step in alignment with ventral displacement of the caudal tip of the tail. | *Röntgenbilder des Schwanzes von Fall 3. A: Dorsoventrale Röntgenaufnahme mit kranialer Seite am oberen Bildrand und linker Seite am linken Bildrand. Man beachte die schwere Osteolyse eines der Steißbeinwirbel und die Weichteilverletzung im distalen Segment des Schwanzes. B: Laterolaterales Röntgenbild mit kranialer Seite auf der linken Seite des Bildes. Man beachte die kleine Stufe in der Ausrichtung mit Ventralverschiebung der kaudalen Schwanzspitze.*

Five months post-operatively the horse showed a recurrence of the masses on the tail stump. Histopathology confirmed that the recurred masses were again an amelanotic melanoma. The owner did not want any further diagnostics nor a second operation and the horse was euthanised.

Case 3

The horse received meloxicam (Metacam® 0,6 mg/kg btw p.o. (orally)) once daily for 2 days post-operatively. Three days after surgery the horse was discharged and there were no complaints in wound healing.

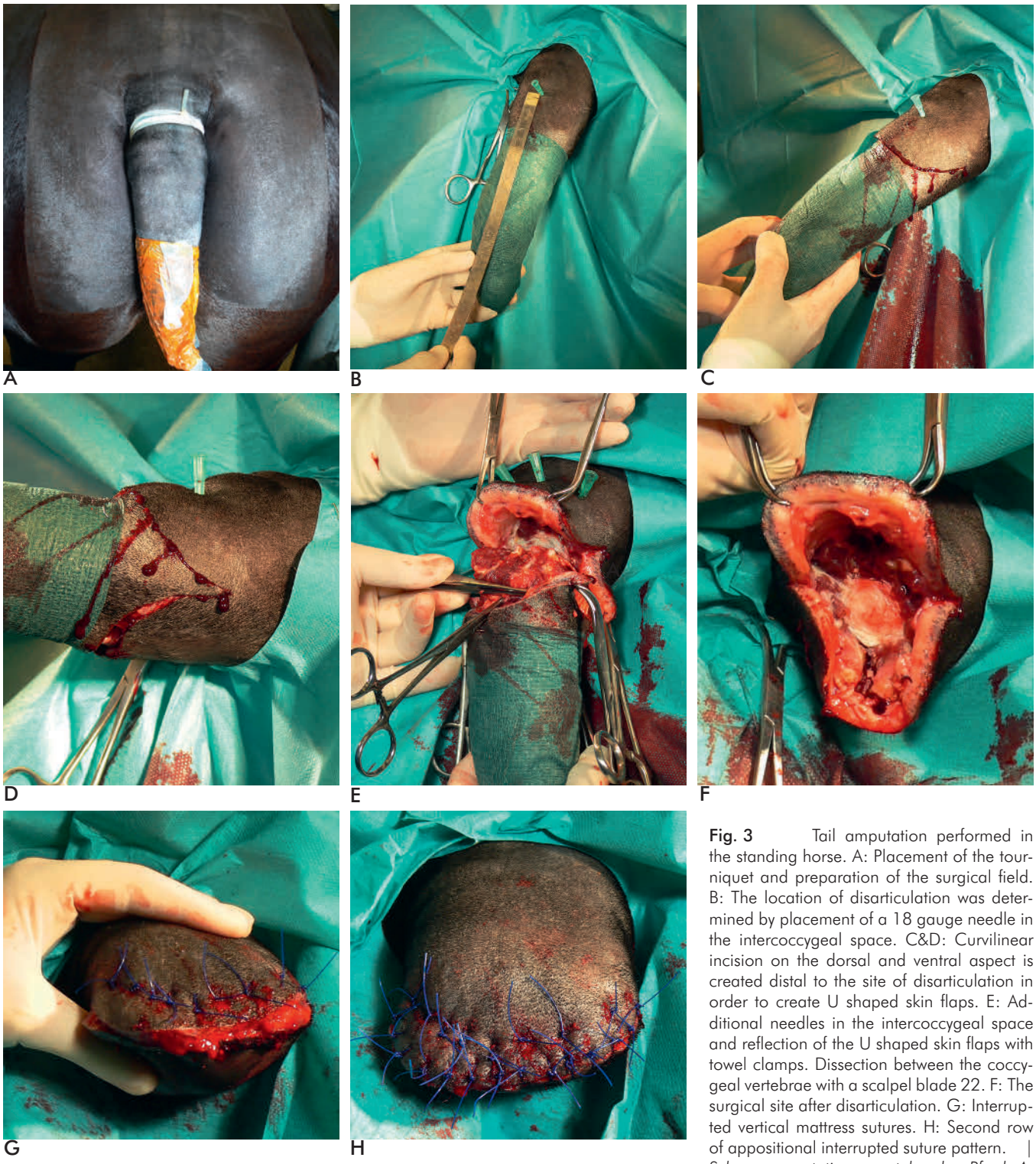

Fig. 3 Tail amputation performed in the standing horse. A: Placement of the tourniquet and preparation of the surgical field. B: The location of disarticulation was determined by placement of a 18 gauge needle in the intercoccygeal space. C&D: Curvilinear incision on the dorsal and ventral aspect is created distal to the site of disarticulation in order to create U shaped skin flaps. E: Additional needles in the intercoccygeal space and reflection of the U shaped skin flaps with towel clamps. Dissection between the coccygeal vertebrae with a scalpel blade 22. F: The surgical site after disarticulation. G: Interrupted vertical mattress sutures. H: Second row of appositional interrupted suture pattern. | *Schwanzamputation am stehenden Pferd. A: Anlegen des Tourniquets und Vorbereitung des Operationsfeldes. B: Der Ort der Exartikulation wurde durch Platzierung einer 18-Gauge-Nadel im Intercoccygealraum bestimmt. C&D: Eine gekrümmte Inzision auf der dorsalen und ventralen Seite wird distal der Exartikulationsstelle angelegt, um U-förmige Hautlappen zu schaffen. E: Zusätzliche Nadeln in den Intercoccygealraum und Spiegelung der U-förmigen Hautlappen mit Handtuchklammern. Dissektion zwischen den Steißbeinwirbeln mit einer Skalpellklinge 22. F: Der Operationsbereich nach der Exartikulation. G: Unterbrochene vertikale Matratzennähte. H: Zweite Reihe des appositionellen unterbrochenen Nahtmusters.*

Histologic tissue characteristics of case 3 (Fig. 4C) were consistent with a high-grade, highly infiltrative undifferentiated sarcoma with marked nuclear pleomorphism and frequent mitotic figures. Since the neoplastic cell did not make a noticeable amount of intercellular matrix, and because a large number of neoplastic cells were positive in IHC for S100, the neoplasm was diagnosed as a high-grade amelanotic melanoma.

Two months after surgery the horse showed recurrence of the masses, severe neurologic signs and became recumbent at home. It was not referred to the Equine University Hospital and was euthanised at home. No post-mortem autopsy was performed.

Discussion

This case series describes three non-grey horses with melanocytic masses on the tail in which tail amputation in the standing horse was selected as surgical treatment. Two of the three horses showed recurrence in 2 and 5 months after surgery and were euthanised. When horses are presented with a mass on the tail, the list of differential diagnoses includes a multitude of different neoplasms, as well as benign or reactive/inflammatory lesions of the skin. Previously described masses on the tail include melanocytic tumours, basal cell carcinomas, sebaceous adenomas, carcinomas and schwannomas (*Knottenbelt* et al.[10,11]; *Poore* et al.[1]; *Schöniger* et al.[12]; *Valentine* et al.[3]). Also other benign masses or neoplastic masses should be considered especially in non-grey horses. This case series included a presumptive dermal melanoma and two amelanotic melanomas.

Achieving a correct diagnosis is important in order to determine a suitable treatment plan and the prognosis or likelihood of recurrence. In case 2, histopathology of biopsies taken pre-operatively suggested a trichoblastoma. However, histopathology after surgery suggested a (largely amelanotic) melanoma, which stresses the importance of histopathology after mass removal. Since trichoblastomas can contain melanin pigment, differentiation between a epithelial or melanocytic origin of a neoplasm is of clinical importance, as they carry a different prognosis. In case 3, pre-operative radiographs showed severe osteolysis of the sixth coccygeal vertebra consistent with an osteolytic neoplasm. Together with the pre-operative histopathology, radiographs show to be of additional diagnostic value. Anaplastic sarcomas are considered to have a highly invasive growth pattern (*Knottenbelt* et al.[13]) and therefore the prognosis is guarded. Extradural undifferentiated sarcomas causing spinal cord compression and extensive vertebral bone invasion have been previously reported in horses (*Knottenbelt* et al.[13]). For amelanotic melanomas, the prognosis is considered poor according to *Knottenbelt* et al.[2]. When the horse showed recurrence of the mass and suffered from neurological signs the horse was euthanised and unfortunately no post-mortem autopsy was performed. Case 1, with a presumptive dermal melanoma, also had a mass in the rectal wall. The mass was clinically suspected to be another melanoma or a lymph node as part of the iliosacral lymph centre. This finding was discussed with the owner and since surgical treatment in the rectal wall was not advised, only tail amputation was performed. It was recommended to monitor the mass in the rectal wall every 6 months. However, the horse was lost to follow-up. The overall prognosis of dermal melanomas should be considered as guarded, since they can become malignant over time (*Knottenbelt* et

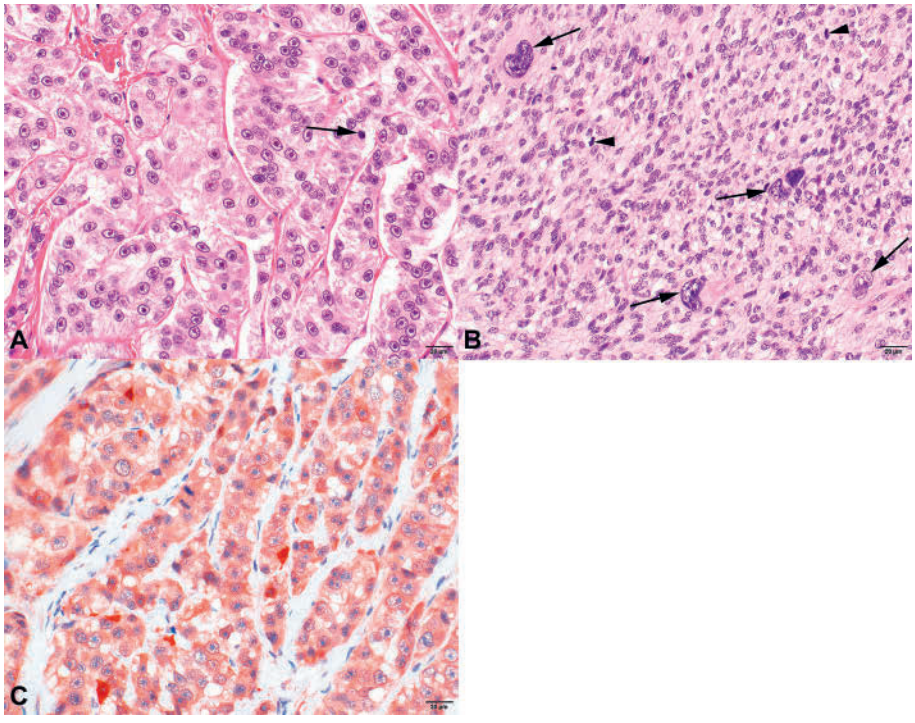

Fig. 4 Representative histological pictures of haematoxylin and eosin-stained tissue sections of case 2 (A & C), case 3 (B). In case 1 no histopathology was performed. The neoplasm of case 2 is characterized by cords and nests of rather uniform epithelioid neoplastic cell with prominent nucleoli, amphophilic cytoplasm without visible melanin pigment, and moderate numbers of mitotic figures (arrow). The neoplastic cells of case 3 show marked nuclear pleomorphism (arrows) and frequent mitotic figures (arrowheads). As in case 2, the neoplastic cells do not contain visible melanin pigment. Fig. 4C shows moderate to strong immunoreactivity in the neoplastic cells of case 2. The neoplastic cells of case 3 showed a similar staining pattern. | *Repräsentative histologische Bilder von mit Hämatoxylin und Eosin gefärbten Gewebeschnitten von Fall 2 (A & C), Fall 3 (B). In Fall 1 wurde keine Histopathologie durchgeführt. Das Neoplasma von Fall 2 ist gekennzeichnet durch Stränge und Nester aus ziemlich einheitlichen epitheloiden neoplastischen Zellen mit prominenten Nukleoli, amphophilem Zytoplasma ohne sichtbares Melaninpigment und einer mäßigen Anzahl mitotischer Figuren (Pfeil). Die neoplastischen Zellen in Fall 3 weisen einen ausgeprägten Kernpleomorphismus (Pfeile) und häufige mitotische Figuren (Pfeilspitzen) auf. Wie in Fall 2 enthalten die neoplastischen Zellen kein sichtbares Melaninpigment. Abb. 4C zeigt eine mäßige bis starke Immunreaktivität in den neoplastischen Zellen von Fall 2. Die neoplastischen Zellen von Fall 3 zeigten ein ähnliches Färbemuster.*

al.[2]). Also no histopathology was performed post-operatively of the removed mass of the tail. The exact nature of the mass therefore remains uncertain. Different reports on tumours of melanocytic origin in non-grey horses, including cases of malignant melanomas, state that a definite diagnosis should be based on both cytologic and histopathologic examination because cells containing melanin pigment can also be found in epithelial neoplasms (*Poore* et al.[1]; *Valentine* et al.[3]; *LeRoy* et al.[14]).

Keeping the prognoses mentioned above in mind for the different masses, one might conclude that a thorough clinical examination, possibly including rectal examination and additional diagnostics such as preoperative histopathology, a radiographic study of the tail, as well as sentinel lymph node ultrasonography are essential in order to determine the best surgical plan and prognosis. Histopathology after surgical removal gives more information on the definite diagnosis, prognosis, evaluation of surgical margins and associated risk of recurrence.

Surgical tail amputation has been performed in horses for different indications such as tail docking, excision of neoplasms and traumatic injuries to the tail (*Lefebvre* et al.[6], *McMaster* et al.[7], *Poore* et al.[1], *Riddell* et al.[8]). The preferred site for disarticulation is the intercoccygeal space. Since the coccygeal vertebrae are small, a needle can be placed lateral to a vertebral body instead of in the actual intercoccygeal space. This is a possible explanation for having to transect the vertebra in one of the horses. Site of amputation in all three cases was determined based on clinical appearance of the skin at the proposed amputation site and location of the mass. Since the masses in all cases were located in the mid and distal tail region there was enough surgical margin possible. For future cases, the surgical excision margin should be more objectively measured.

Limitations of this case series are the retrospective nature and the small number of cases. Furthermore, no post-operative histopathology was performed in case 1. In the latter case this limits information on diagnosis and excisional margins. Another limitation is the non-objective measure to determine the site of amputation during surgery. In case 3, no information was available for the excision margins on histopathology after surgery. When recurrence appeared at the amputation site in this case and the horse suffered from severe neurological signs, no post-mortem autopsy was performed as the horse was euthanised at home. Post-mortem autopsy could have provided a better understanding of the clinical signs and a possible cause for the neurological complaints.

Conclusion

In the authors' opinion, tail amputation as a standing procedure is a good and valid option for horses with masses on the tail with a non-neoplastic origin or with low-malignant characteristics. Tail amputation in the mid-tail or distal tail region does not influence performance levels nor increases insect harassment.

Pre-operative diagnostics are essential to determine the correct diagnosis, treatment plan and prognosis. The type of mass and the additional findings in the pre-surgical work-up can influence the width of surgical excision margins. Performing histopathology post-operatively, is essential to determine the surgical excision margins and the associated risks of recurrence. Amelanotic melanomas in non-grey horses have high malignant characteristics and therefore survival time is considered short. Tail amputation as a surgical treatment in these cases has a guarded prognosis.

Ethical approval

Informed consent was received from the owners for the use of clinical data and images for research purposes and publication.

Conflict of interest statement

None of the authors has any financial or personal relationships that could inappropriately influence or bias the content of the paper.

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Author contributions

E.M.S. Visser managed the clinical cases and prepared the manuscript (writing – original draft/editing). G. Grinwis performed the histopathology and contributed to the description of necropsy findings (writing – review and editing). H. Hermans and J.M. Ensink managed the clinical cases and edited the manuscript (writing – review and editing). S. Veraa performed and contributed to the description of the radiographic examination and edited the manuscript (writing – review and editing). All authors approved the final manuscript.

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m. Midmark, Dayton, Suite 300, 10170 Penny Lane, Miamisburg Ohio 45342
n. Prolene 1 4.0 metric, Ethicon, Johnson & Johnsen Consumer BV Postbus 188 3800 AD Amersfoort, The Netherlands
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