Medical Mycology Case Reports 26 (2019) 28–31

Contents lists available at ScienceDirect

Medical Mycology Case Reports

journal homepage: www.elsevier.com/locate/mmcr

Unusual presentation and urinary tract obstruction due to disseminated intra-abdominal *eumycetomas* caused by *Curvularia* species in a dog

Joe Herbert[a,*], Deborah Chong[a], Derek Spielman[a,b], Mark Krockenberger[a,b], Jamie Wildner[a], Richard Bishop[c]

[a] Sydney School of Veterinary Science, University of Sydney, Camperdown, New South Wales, Australia
[b] Veterinary Pathology Diagnostic Services, University of Sydney, Camperdown, New South Wales, Australia
[c] Alice Springs Veterinary Clinic, Alice Springs, Northern Territory, Australia

ARTICLE INFO

Keywords:
Eumycetoma
Black grain
Curvularia
Canine
Urinary tract obstruction

ABSTRACT

Intra-abdominal eumycetomas are rare in dogs and usually attributed to contamination of surgical wounds post-operatively. This is the first report of extensively disseminated intra-abdominal eumycetomas due to *Curvularia* resulting in urinary tract obstruction and associated chronic recurrent urinary tract infections in a Labrador retriever. Identification of the fungal genus was performed on samples obtained from culture of eumycetomic fungal grains that had been collected sterilely at necropsy.

1. Introduction

Eumycetomas are chronic pyogranulomatous lesions caused by moulds, frequently reported in humans living in tropical and sub-tropical environments (e.g. Madura Foot) but rarely in dogs [1–6]. Usually restricted to subcutaneous tissues, there have been only two reports of cases involving intra-abdominal lesions in dogs [4–6]. These were associated with the uterine stump and the caudal aspect of the right kidney, caused by *Madurella mycetomatis* and *Penicillium duponti* respectively [4,6]. In both cases, infection was attributed to contamination of the surgical wound post ovariohysterectomy dehiscence [4,6]. The case reported here is the first report of extensive intra-abdominal dissemination and associated lower urinary tract obstruction in a dog caused by eumycetomas of the *Curvularia* species.

2. Case

A nine-year-old female desexed Labrador retriever presented to the Alice Springs Veterinary Hospital in March 2017 (day 0) because of two ventral abdominal masses that had been gradually increasing in size. The dog was also suffering from an ongoing urinary tract infection and was in the 14th day of a 21 day course of oral antibiotics amoxycillin-clavulanic acid (Noroclav®) at a dose of 500mg (15.1mg/kg) BID. This episode of urinary tract infection was the fifth in the last nine months, with each episode characterised by haematuria, sanguinous vulval discharge and urinary incontinence. Prior urinary tract infections had resolved upon commencing treatment with oral antibiotics amoxycillin-clavulanic acid (Noroclav®) at a dose of 500mg BID, but would re-occur 2 weeks to 4 months later.

The two masses had been first detected 9 months prior (day −286), when the dog had presented to the same clinic for the first episode of urinary tract infection. The most cranial mass was immediately caudal to the xiphoid and adjacent to the spleen, while the more caudal mass was in the area of the bladder. On day −286, fine needle aspirates were collected from the two masses and sent to a commercial diagnostic laboratory for cytology and culture. Several fungal hyphae, neutrophils, lymphocytes and macrophages were seen on cytology, and culture resulted in the growth of a fungus. While identification of the cultured fungus was not successful, based on the cytology and culture findings, the masses were suspected to be eumycetomas that arose due to an incomplete excision of a previous intra-abdominal eumycetoma 31 months prior (day −951).

On day −951, the dog had an intra-abdominal eumycetoma surgically excised. This eumycetoma was attached to the abdominal wall with adhesions to several viscera including the bladder, and had an associated draining tract opening on the ventral midline. The corresponding histopathology report stated that numerous intra-lesional darkly pigmented occasionally septate fungal hyphae were present. The dog had a history of frequently running through parklands with lots of thorny shrubs. Therefore, it was hypothesised that the eumycetoma likely arose from inoculation of the fungus during a minor subcutaneous penetration of a grass seed or thorn contaminated by soil

* Corresponding author.
E-mail address: vetjoeherbert@gmail.com (J. Herbert).

https://doi.org/10.1016/j.mmcr.2019.09.002
Received 15 July 2019; Accepted 18 September 2019
Available online 19 September 2019

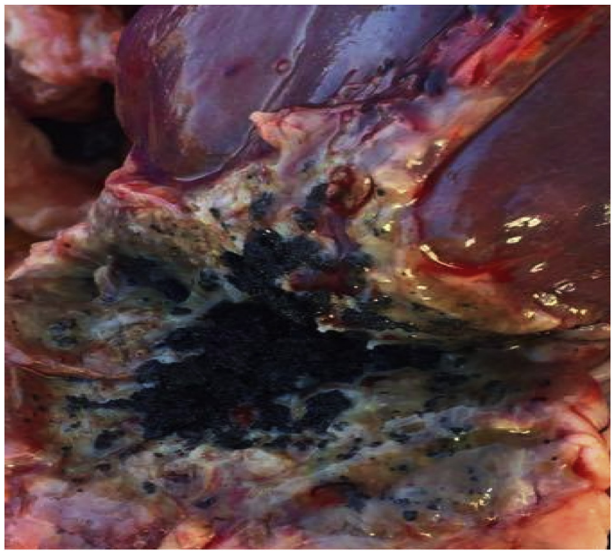

Fig. 1. Cross section of eumycetoma adhered to the spleen and visceral fat.

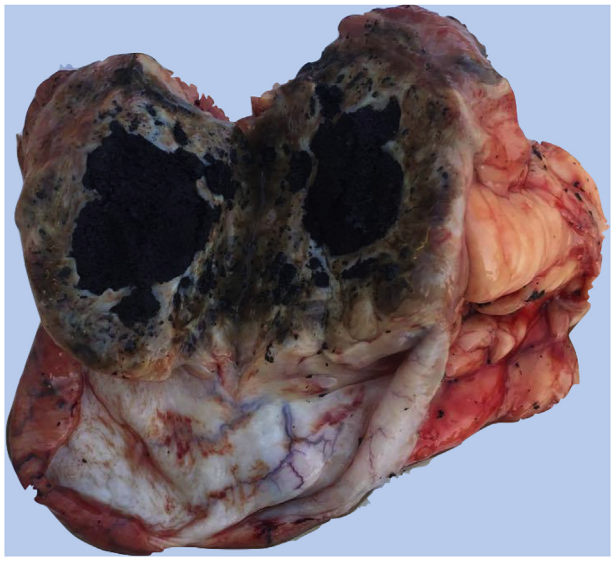

Fig. 2. Cross section of eumycetoma adhered to the bladder.

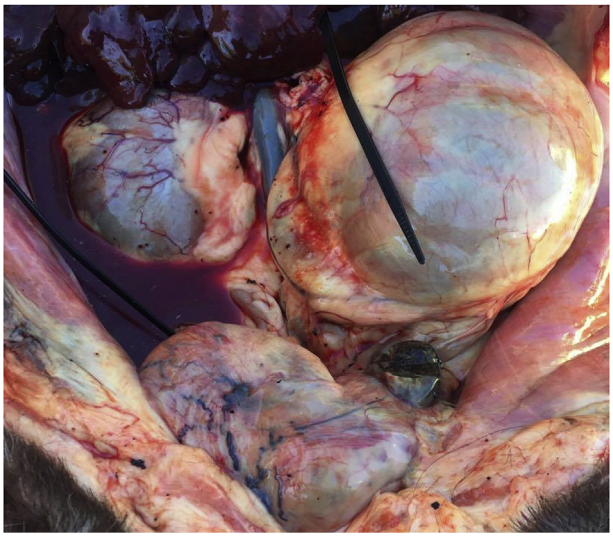

Fig. 3. Urinary tract *in situ* with the black marker on the surface of the left kidney.

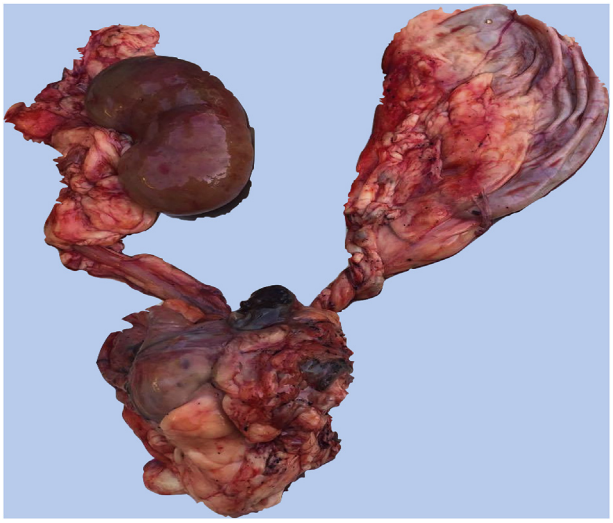

Fig. 4. Urinary tract *ex situ* with left kidney at least twice the size of the right kidney.

containing the fungus. The owner had since stopped such trips to those areas to avoid further exposure.

At presentation on day 0, the dog weighed 33 kg with a body condition score of 5.5/9, and had a normal cardinal vitals. The two ventral abdominal firm masses were palpated. A discharging sinus on the ventral midline in the region of the umbilicus was also detected and appeared to be associated with the caudal mass. The discharge consisted of clear gelatinous exudate with black grains. No other abnormalities were detected on physical examination.

The concurrent occurrence of the chronic recurring urinary tract infection and increase in the size of the caudal mass compared to what had been noted on day −286, led the clinician to believe the caudal mass could be impinging on the bladder preventing normal voiding resulting in the urinary tract infections recurring. Furthermore, it was hypothesised that the newly developed draining tract could provide a pathway for further pathogens to enter the abdominal cavity and cause further complications. Exploratory laparotomy was thus elected to remove the two masses on day 1.

During surgery it was noted that the cranial mass was adherent to the abdominal wall and measured 6 cm × 6 cm x 2cm in size and the draining tract was shown to extended along the fascial planes from the subcutaneous tissue into the abdominal cavity. The caudal mass encapsulated the bladder, firmly adhered to its dorsolateral and caudal walls. Together with the bladder, this measured 10 cm × 10 cm x 10cm. Several other smaller distinct firm masses were also found attached to other viscera, including the stomach, spleen and uterine stump. Only the large cranial abdominal mass was removed as the growth associated with the bladder formed a tight adhesion where the mass appeared to originate from within the bladder wall. Due to the size of the bladder mass and the amount of wall which was affected, surgical removal was not performed with the intention of medically treating the patient in the attempt to reduce the volume of this mass with the expectation of excising this at a later date.

After removal, the cranial abdominal mass was sectioned to reveal a core composed of numerous black grains that could be easily removed. These grains resembled those seen in the exudate from the draining tract. The mass was fixed in 10% neutral buffered formalin at a tissue to formalin ratio of 1:10. It was then submitted to the Veterinary Pathology Diagnostic Services at the Sydney School of Veterinary Science for histopathology. The cranial abdominal mass was confirmed

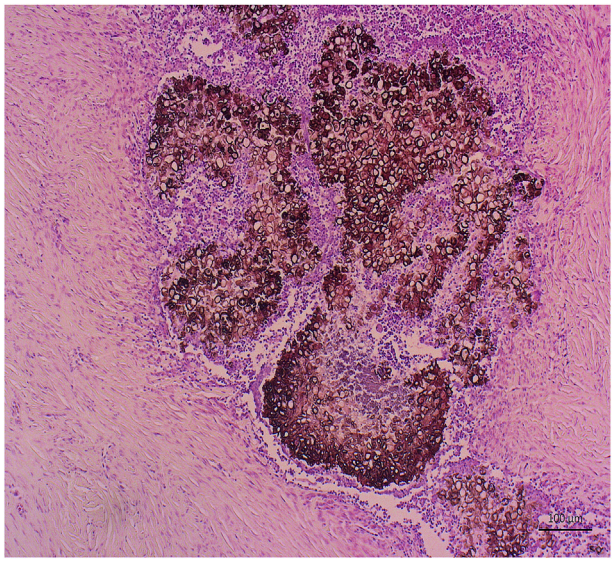

Fig. 5. H&E stained section of the eumycetoma adhered to the bladder at 100 x magnification showing a foci of necrosis and fungal material surrounded by marked pyogranulomatous inflammation and fibrosis.

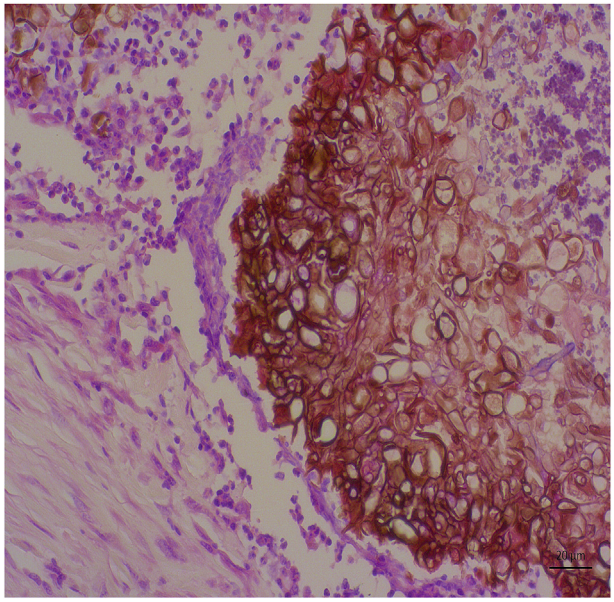

Fig. 6. H&E stained section of the eumycetoma adhered to the bladder at 400 x magnification, showing the darkly pigmented fungal vesicular structures and hyphae that are occasionally septate.

to be a eumycetoma composed of marked pyogranulomatous inflammation and fibrosis surrounding necrotic areas containing numerous darkly pigmented occasionally septate fungal hyphae and cell walls.

Anti-fungal therapy was started on day 3 with oral itraconazole at 5mg/kg SID for 90 days (this was started pre-definitive diagnosis and continued for 90 days at which point a re-check was scheduled) in an attempt to reduce the bladder mass size and to control any possible systemic and/or intra-abdominal dissemination of the remaining fungi. However, the dog continued to have urinary tract infections and urinary incontinence for the whole ninety days after treatment commenced. Due to cost constraints, euthanasia was elected on day 97.

With the owner's consent, a necropsy was performed on day 98. Several firm pale masses were tightly adhered to the visceral fat and capsular surface of abdominal viscera, including the caudodorsal and lateral aspects of the bladder, visceral surface of the spleen, greater curvature of the stomach and uterine stump (these were not present during exploratory laparotomy). The center of the masses contained numerous black grains on cut section that could be easily scooped and washed out (Fig. 1; Fig. 2). This was similar to that seen during the exploratory laparotomy of the cranial abdominal mass most recently removed. In addition, the left kidney was grossly enlarged, measuring 14 cm × 10 cm x 8cm (Fig. 3; Fig. 4) and consisted of a urine filled thin walled sac with no grossly visible cortex or medulla (no renal involvement was observed during the exploratory laparotomy). The right kidney appeared to be of a normal size, measuring 7 cm × 5 cm x 3.5cm, with normal gross architecture on cut section (Fig. 3; Fig. 4).

At necropsy, the masses were collected and fixed in 10% neutral buffered formalin at a tissue to formalin ratio of 1:10, and submitted to the Veterinary Pathology Diagnostic Services at the Sydney School of Veterinary Science for histopathology. The masses consisted of a fibrotic capsule surrounding areas of severe pyogranulomatous inflammation associated with foci of necrotic tissue and fungal material (Fig. 5). The infectious material was composed of numerous pigmented vesicular structures and irregular brown, occasionally septate fungal hyphae with some degree of branching (Fig. 6). The microscopic appearance of these masses was thus identical to that of the cranial abdominal mass removed during the exploratory laparotomy. Examination of the masses adhered to the abdominal viscera, including the bladder, showed that the inflammation and fungal elements were limited to the serosa, which was greatly thickened. In the left kidney, there was marked widespread interstitial fibrosis and loss of most of renal parenchyma, with mostly degenerate glomeruli and renal tubules, and very occasionally regenerating tubular cells remaining were also seen (Fig. 7). A mild multifocal lymphoplasmacytic interstitial infiltrate was also present and in the right kidney, there was diffuse moderate dilation of the tubules, with wispy amorphous eosinophilic proteinaceous material in their lumens (Fig. 8).

During necropsy, the grains from the masses were also collected sterilely for culture and placed in transport medium. These were submitted to the Veterinary Pathology Diagnostic Services at the Sydney School of Veterinary Science for culture and fungal identification. The grains were washed with sterile saline solution with 70% alcohol, and crushed sterilely. Culture using the crushed grains was performed using plain sabouraud dextrose agar and sabouraud dextrose agar containing gentamycin and chloramphenicol, incubated at 28 and 37° celsius. Amplification and sequence analysis of internal transcribed spacers and the partial large subunit of the 25–28s ribosomal RNA regions of fungus cultured was performed, identifying this as belonging to the *Curvularia* species.

3. Discussion

The ante-mortem and post mortem findings confirm the intra-abdominal masses to be black-grained eumycetomas due to *Curvularia* species [1–6]. The similar histological appearance between the eumycetomas examined in this investigation and the one removed from the dog three years prior, suggests that they are likely to be caused by the same fungus. This is supported by the history of the owner not further visiting areas similar to those where the dog originally picked up the first infection, greatly reducing the risk of sustaining a new penetrating injury by contaminated material. Therefore, the eumycetomas in the latest investigation was likely a regrowth of intra-abdominal remnants due to incomplete removal or secondary to accidental contamination of the abdomen during surgery three years prior.

The severe unilateral hydronephrosis of the left kidney and tubular dilation of the right kidney is likely due to outflow obstruction secondary to the bladder's growth. Furthermore, the involvement of the bladder wall was so significant that the transitional epithelium would have not been able to distend and contract normally, further preventing complete filling and voiding, thus predisposing the patient to

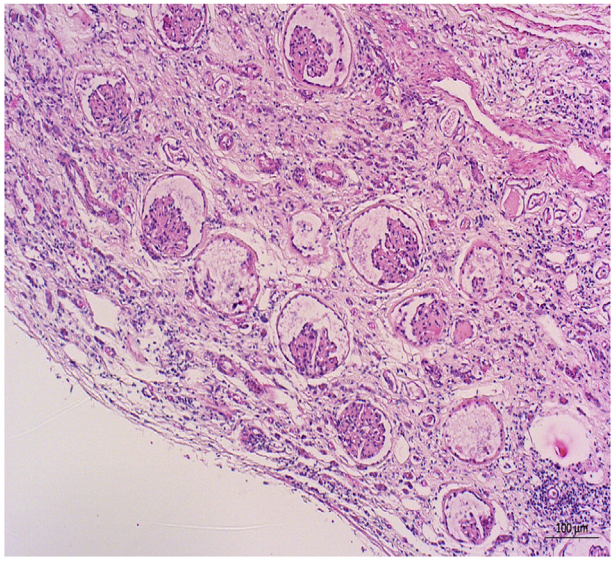

Fig. 7. H&E stained section of the left kidney at 50 x magnification showing marked interstitial fibrosis, degeneration and loss of renal tubules and glomeruli, and occasional renal tubular regeneration.

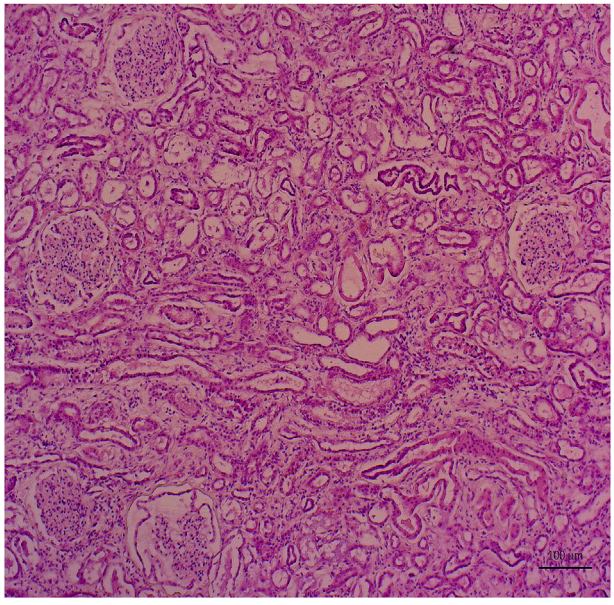

Fig. 8. H&E stained section of the right kidney at 50 x magnification showing moderate renal tubules dilation.

pathologies such as urinary tract infections. Along with the chronic nature of the renal lesions, we suspect that the growth of the eumycetoma started before the dog's first episode of urinary tract infection and incontinence. The thick fibrotic capsule surrounding the fungal growths likely prevented penetration by itraconazole, hence resulting in the anti-fungal treatment being ineffective.

Eumycetomas in dogs typically arise from traumatic inoculation of soil contaminated with mould into the skin or subcutaneous tissue [1–3]. These are characterised by painless tumefaction, development of draining sinuses several months post-inoculation, and macroscopic pigmented grains containing fungal hyphae in the exudate [1–3]. Treatment involves surgical excision and long-term anti-fungal therapy, but successful elimination of the fungus is rare [4–6].

Apart from *Curvularia*, several other species of mould from the genera of *Aspergillus*, *Cladophialophora, Madurella, Penicillium,* and *Scedosporium*, have been reported to cause eumycetomas in dogs [4–6]. Fungi of the *Curvularia* species are typically found in arid areas similar to Alice Springs where the dog lived [1–3]. They are ubiquitous environmental soil saprophytes, that get picked up through inoculation of the skin or subcutaneous tissues of the host via traumatic penetration of contaminated material [1–3]. While *Curvularia* species have been reported to cause phaeohyphomycosis, and subcutaneous eumycetomas in dogs, this is the first report of this species causing intra-abdominal eumycetomas [4–7].

In conclusion, this novel case of recurrent intra-abdominal eumycetomas highlights the necessity for complete excision of such masses. Furthermore, performing regular abdominal ultrasound rechecks for early detection is advised in animals which have previously received surgery to remove a fungal mass as this allow early identification of re-growths. It also suggests that extra-luminal fungal granulomas should be added to the list of differentials for lower urinary tract obstructions.

Funding

There was no external source of funding. All time was donated by the authors and laboratory equipment was provided by the University of Sydney Veterinary Pathology department.

References

[1] B. Bustamante, P.E. Campos, Eumycetoma, in: C. Kauffman, P. Pappas, J. Sobel, W. Dismukes (Eds.), Essentials of Clinical Mycology, second ed., Springer, New York, 2011, pp. 415–425.
[2] B.H. Schmitt, Fungal infections, in: B.H. Schmitt (Ed.), Atlas of Infectious Disease Pathology, Springer International Publishing, Cham, 2017, pp. 101–172.
[3] D.A. Sutton, M.G. Rinaldi, S.E. Sanche, Dematiaceous fungi, in: E.J. Anaissie, M.R. McGinnis, M.A. Pfaller (Eds.), Clinical Mycology, second ed., Churchill Livingstone, Edinburgh, 2009, pp. 329–354.
[4] N. Lambrechts, M.G. Collett, M. Henton, Black grain eumycetoma (Madurella mycetomatis) in the abdominal cavity of a dog, Med. Mycol. 29 (1991) 211–214.
[5] P.-L. Sun, et al., Canine eumycetoma caused by Cladophialophora bantiana in a Maltese: case report and literature review, Mycoses 56 (2013) 376–381.
[6] J. Janovec, D.J. Brockman, S.L. Priestnall, N.J. Kulendra, Successful treatment of intra-abdominal eumycotic mycetoma caused by Penicillium duponti in a dog, J. Small Anim. Pract. 57 (2016) 159–162.
[7] P. Herráez, C. Rees, R. Dunstan, Invasive phaeohyphomycosis caused by *Curvularia* species in a dog, Vet. Pathol. 38 (2001) 456–459.