HOSTED BY
ELSEVIER

Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

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

Case report http://dx.doi.org/10.1016/j.apjtb.2016.01.009

Sudden death in a captive meerkat (*Suricata suricatta*) with arterial medial and myocardial calcification

Laura Bongiovann[1*], Nicola Di Girolamo[2], Leonardo Della Salda[1], Marcella Massimi[1], Mariarita Romanucci[1], Paolo Selleri[2]

[1]*Faculty of Veterinary Medicine, University of Teramo, Località Piano D'Accio 64100, Teramo, Italy*

[2]*Clinic for Exotic Animals, Center of Veterinary Specialists, Via Sandro Giovannini 53, 00137, Rome, Italy*

ARTICLE INFO

Article history:
Received 20 Oct 2015
Accepted 22 Nov 2015
Available online 18 Jan 2016

Keywords:
Meerkat
Suricata suricatta
Arterial calcification
Myocardial calcification

ABSTRACT

A 1-year-old male meerkat was found dead by the owner. The animal was clinically healthy and was regularly vaccinated for distemper virus. Necropsy revealed multifocal to confluent dry white areas in the myocardium, pneumonia and congestive hepatopathy. All the other organs, including gross vessels, were macroscopically normal. The heart showed histologically large, multifocal to confluent areas of mineralization of the myocardium and the wall of small coronary artery. Vascular calcifications were also observed in the hepatic portal tracts and kidneys arteries of small/medium sizes. The arterial lumen appeared narrowed and the wall thickened due to the calcification of the tunica media. In veterinary medicine, arterial mineralization is regarded as a metastatic calcification, as the result of hypercalcemia and/or hyperphosphatemia. However, today, the pathogenesis of medial artery calcification in humans seems to be the results of an active process resembling embryonic osteogenesis, rather than a mere passive process.

1. Introduction

Very little is known about the pathology of meerkat (*Suricata suricatta*), small carnivores belonging to the family Herpestidae, originating from the South Africa, despite these animals have gained in popularity in recent years. They also live in captivity in numerous zoos worldwide and they recently have been regarded as pet animals, but with poor results, due to their aggressiveness and territoriality. The detention of meerkats as pet animals is however forbidden in several countries. Most of the pathologies reported in meerkats are sporadic/rare tumors in captive animals and infectious diseases, in particular tuberculosis and toxoplasmosis, described in both wild and captive populations [1–7]. Three cases of cholesterol granulomas have been reported, associated with arterial atherosclerosis in one case [8].

2. Case report

A 1-year-old male meerkat (*Suricata suricatta*), housed alone in an external enclosure, was found dead by the owner. No abnormalities were noticed regarding feeding habit or behavior the days before the death. The meerkat was clinically healthy upon previous physical examinations and was regularly vaccinated for distemper virus. Diet consisted of dry cat food supplemented with chicken breast once every two days. The meerkat had unlimited access to drinking water.

Necropsy revealed multifocal to confluent dry white areas in the myocardium, also visible at the section of the organ (Figure 1a,b). Lungs showed multifocal to coalescent areas of discoloration associated to a dark appearance and increase of consistence (pneumonia) (Figure 1c). In the liver, there were multifocal small white areas, diffused on the entire surface of the organ and visible also on the cut surface ("nutmeg liver") (Figure 1d). All the other organs, including gross vessels, were macroscopically normal.

Samples from heart, liver, lung and both kidneys were taken and routinely fixed in 10% neutral buffered formalin, embedded in paraffin wax, and 5 μm-thick sections were examined using hematoxylin and eosin staining and visualized by light microscope. In order to better visualize the presence of calcium in the tunica media, the alizarin staining was performed.

*Corresponding author: Laura Bongiovanni, Faculty of Veterinary Medicine, University of Teramo, Località Piano D'Accio 64100 Teramo, Italy.
Tel: +39 0861 266890
E-mail: lbongiovanni@unite.it

Peer review under responsibility of Hainan Medical University. The journal implements double-blind peer review practiced by specially invited international editorial board members.

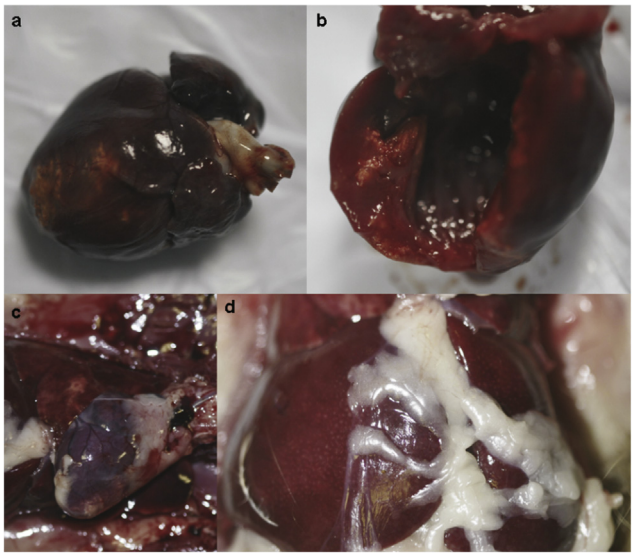

Figure 1. Multifocal to confluent dry white areas in the surface of the myocardium (a), also visible at the section of the organ (b); lungs showed multifocal to coalescent areas of discoloration associated to a dark appearance and increase of consistence (pneumonia) (c); in the liver, there were multifocal small white areas, diffused on the entire surface of the organ and visible also on the cut surface (d).

Histological examination of the heart revealed large, multifocal to confluent areas of myocardial mineralization. The lesions appeared as extensive and multiple areas of mineralized lacunae (Figure 2a). The mineralized substance appeared as a basophilic, compacted, acellular, and amorphous material, with irregular borders (Figure 2b), surrounded by a mild to moderate amount of fibrotic tissue (Figure 2b, asterisk). Small coronary arteries showed degeneration of the media smooth muscle cells (Figure 2c) with small foci of initial mineralization (Figure 2c, arrow) and larger areas of calcification expanding the wall (Figure 2d, arrow).

Vascular mineralization was also observed in the small/medium sizes arteries of hepatic portal tracts and kidneys. In most of the vessels, the lumen appeared narrowed and the wall thickened due to the calcification of the tunica media.

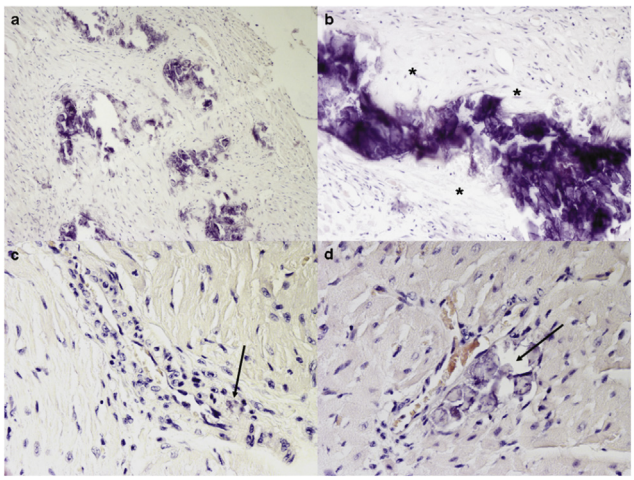

Figure 2. Large, multifocal to confluent areas of mineralized lacunae in the myocardium (10×) (a); aspect of the mineralized substance: basophilic, compacted, acellular, and amorphous material, with irregular borders (b), surrounded by a mild to moderate amount of fibrotic tissue (20×) (b, asterisk); degeneration of the media smooth muscle cells of small coronary arteries (c) with small foci of initial mineralization (c, arrow) and larger areas of calcification expanding the wall (40×) (d, arrow).

The lesions ranged from mild or early-to-severe or advanced degrees of calcification. In more severe or advanced cases, the intimal and/or adventitial layers were also affected and the vessel layers could not be distinguished. Areas of calcification varied in size from small segments of calcified elastic fibers to extensive and multiple areas of mineralized lacunae. Moderate, centrolobular hepatocyte vacuolar degeneration were also observed. In the lung, there was a multifocal inflammatory infiltration within the alveoli and bronchiole, characterized by numerous neutrophils, admixed with fibrin and few macrophages and lymphocytes. The interstitium was also multifocally infiltrated with the same type of cells, associated with multifocal edema. No mineralization was observed in the arteries of the pulmonary tissue.

3. Discussion

In the present case report, a diagnosis of arterial and myocardial calcification, hepatic steatosis and bronchiolointerstitial pneumonia was made. The animal died suddenly, and neither clinical examination nor further investigations were performed. The sudden death could be related to the extensive areas of myocardial necrosis, that, together with the multifocal vascular calcification involving small and medium size arteries of different organs, were the main lesions noticed.

Arterial calcification is characterized by the calcium mineral deposition within one or more layers of the arterial vessel wall. It can occur in the tunica media and/or in the intima, where it is always associated with atherosclerosis in animals and humans [9,10].

In veterinary medicine, arterial mineralization (calcification) is frequently described, either as a dystrophic or metastatic process. Dystrophic mineralization occurs in areas of inflammation, degeneration and thrombosis (not necessarily associated to arteriosclerosis) and represents a mineralization of necrotic tissue. Metastatic calcification is the result of hypercalcemia and/or hyperphosphatemia. In animals, this situation is described during diseases such as vitamin D toxicosis, pseudohyperparathyroidism, chronic renal disease [9]. No histopathological lesions were observed in the kidneys, indicating a chronic renal failure as an unlikely underlying cause of the arterial calcification. Unfortunately, since the animal died suddenly, neither clinical examination nor further investigations were performed, and we do not know the calcemic status of the animal, and its biochemical profile. However, we observed that mineralization clearly arose in the tunica media of small-medium sized vessels. This condition has been described in domestic animals as the equivalent of Monckeberg's medial sclerosis of humans [9]. Indeed, in human medicine, two categories of vascular calcification have been described: intimal (associated with atherosclerotic plaques) and medial [10]. The exact pathogenesis of medial artery calcification in humans is still poorly understood. One hypothesis is that it is the results of an active process resembling embryonic osteogenesis, in which vascular smooth-muscle cells may acquire potential biomineralizing capabilities by undergoing osteogenic and/or chondrogenic differentiation and several proteins normally involved in bone mineralization are also present in calcified areas of the arterial wall [8].

In conclusion, arterial medial calcification has been rarely described in animals. The current case describes the presence of dramatic mineralization of the tunica media of small and medium-sized arteries of the heart, liver and kidney, in

association with myocardial mineralization in a captive meerkat. The cause of arterial medial calcification remains undetermined.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

The authors thank Francesco Origgi for the helpful discussions on the slides and Marina Baffoni for the technical support.

References

[1] Aihara N, Une Y. Pleomorphic liposarcoma of the intrathoracic cavity in a meerkat (*Suricata suricatta*). *J Vet Med Sci* 2009; **71**(5): 685-8.
[2] Dadone LI, Garner MM, Klaphake E, Johnston MS, Han S. Anaplastic mandibular carcinoma in a meerkat (*Suricata suricatta*). *J Zoo Wildl Med* 2014; **45**(2): 413-6.
[3] Singh BP, Patterson-Kane JC, Redrobe SP, Chapman JL. Intrarenal pelvic nephroblastoma in a meerkat (*Suricata suricatta*). *J Vet Diagn Invest* 2005; **17**(6): 623-5.
[4] Basso W, Moré G, Quiroga MA, Pardini L, Bacigalupe D, Venturini L, et al. Isolation and molecular characterization of *Toxoplasma gondii* from captive slender-tailed meerkats (*Suricata suricatta*) with fatal toxoplasmosis in Argentina. *Vet Parasitol* 2009; **161**(3–4): 201-6.
[5] Boonsri K, Sritan J, Vechmanus T, O'Sullivan MG, Pringproa K. Intrahepatic cholangiocarcinoma in a captive meerkat (*Suricata suricatta*). *J Zoo Wildl Med* 2013; **44**(3): 740-3.
[6] Drewe JA, Foote AK, Sutcliffe RL, Pearce GP. Pathology of *Mycobacterium bovis* infection in wild meerkats (*Suricata suricatta*). *J Comp Pathol* 2009; **140**(1): 12-24.
[7] Parsons SD, Drewe JA, Gey van Pittius NC, Warren RM, van Helden PD. Novel cause of tuberculosis in meerkats, South Africa. *Emerg Infect Dis* 2013; **19**(12): 2004–7.
[8] Sladky KK, Dalldorf FG, Steinberg H, Wright JF, Loomis MR. Cholesterol granulomas in three meerkats (*Suricata suricatta*). *Vet Pathol* 2000; **37**: 684-6.
[9] Maxie MG, Robinson WF. Cardiovascular system. In: Maxie MG, editor. *Jubb, Kennedy, Palmer's pathology of domestic animals*. Vol. 3. 5th ed. Edimburg: Saunders Elsevier; 2007.
[10] Rocha-Singh KJ, Zeller T, Jaff MR. Peripheral arterial calcification: prevalence, mechanism, detection, and clinical implications. *Catheter Cardiovasc Interv* 2014; **83**(6): E212-20.