

Clinical Case

# Ovarian neoplasm (Luteoma) in a meerkat (*Suricata suricatta*)

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## ABSTRACT

This article describes the case of a 5-year-old female meerkat born under human care at the Cali Zoo in Colombia, which presented a report of abnormal behavior. Upon clinical examination, multifocal and symmetrical bilateral scabbed alopecia was observed. An ultrasonographic evaluation was carried out determining the presence of ovarian cysts. As a therapeutic alternative, an ovariohysterectomy (OVH) was performed with an excisional biopsy of both ovaries, which were sent to the pathology laboratory. The histopathological findings concluded a neoplasm of the left ovary consistent with a Luteoma. Nonetheless, the right ovary did not present significant lesions. During the surgery, blood samples were taken which indicated that the patient presented regenerative anemia, blood chemistry with increased BUN and total proteins associated with hyperglobulinemia indicative of a chronic inflammatory process. The patient recovered satisfactorily from the surgery and after two weeks following the procedure, the dermatological lesions receded, as well as the behavioral problems previously reported.

**Keywords:** Herpestidae, OVH, hormonal problems, ovarian cysts, zoo, ultrasonography (Source: DeCS, MeSH)

## RESUMEN

En este artículo se describe el caso de una *Suricata suricatta* de 5 años, hembra, nacida bajo cuidado humano en el Zoológico de Cali, Colombia, que presentó reporte de comportamiento anormal. Al examen clínico se observó alopecia multifocal y simétrica bilateral con costras. Se realizó una evaluación ultrasonográfica que determinó la presencia de quistes ováricos. Como alternativa terapéutica se realizó una ovariohisterectomía (OVH) con biopsia escisional de ambos ovarios, que fueron remitidos al laboratorio de patología. Los hallazgos histopatológicos concluyeron una neoplasia del ovario izquierdo consistente con un Luteoma. El ovario derecho no presentó lesiones significativas. Durante la cirugía se tomaron muestras de sangre que indicaron que el paciente presentaba anemia regenerativa, química sanguínea con aumento del BUN y proteínas

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totales asociados a una hiperglobulinemia indicativos de un proceso inflamatorio crónico. La paciente se recuperó satisfactoriamente de la cirugía y tras dos semanas posteriores al procedimiento, las lesiones dermatológicas remitieron, así como los problemas de comportamiento previamente reportados.

**Palabras clave:** Herpestidae; OVH; problemas hormonales; quistes ováricos; zoológico; ultrasonografía (*Fuentes: DeCS, MeSH*).

## INTRODUCTION

The Meerkat species is one of 35 species of mongoose in the family Herpestidae and in the genus Meerkat. Meerkats are commonly referred to as Suricate, Grey Meerkat, Thin-tailed Meerkat. According to the IUCN (International Union for Conservation of Nature) they are listed as a minor concern on the red list and their population is stable (1). They are small carnivores that live in desert conditions and are strictly diurnal. They have a life expectancy in the wild of up to 10 years and under human care up to 14 years. (2)

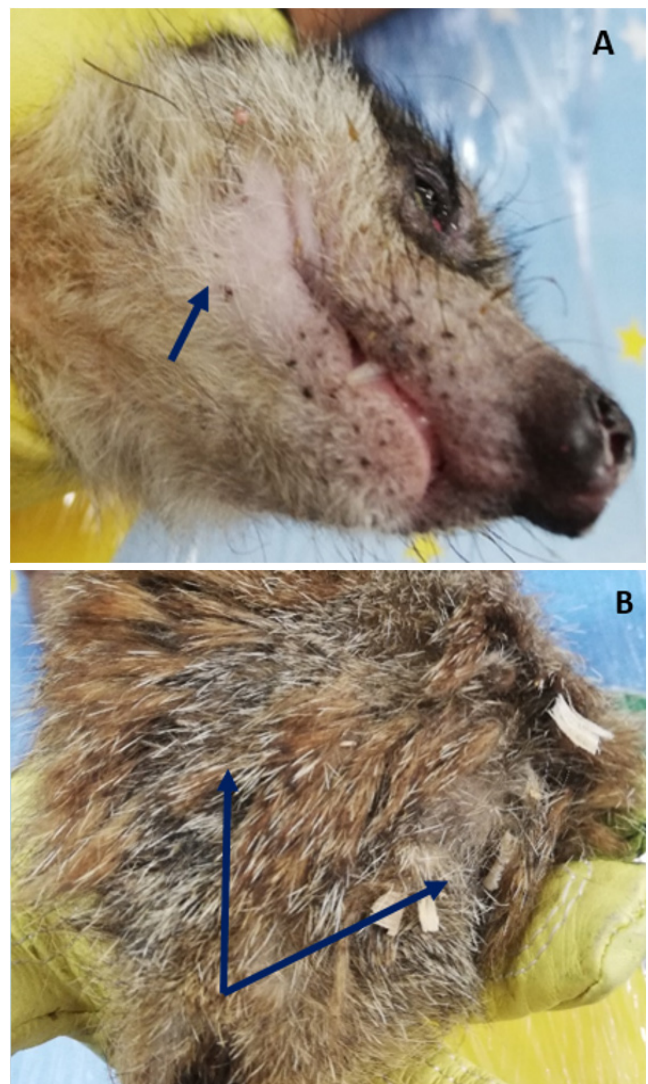
Abnormal conditions in the reproductive system are common in multiple animal species. However, ovarian neoplasms are often not diagnosed because of their subclinical nature (3); and reports of these in meerkats are scarce. The conditions commonly found in these animals living under human care are infectious diseases mainly toxoplasmosis (4,5), degenerative pathologies, cases of cholesteatoma in meerkats, one of them associated to arteriosclerosis (6) and in rare occasions, tumors (4). Therefore, the objective of this case report and corresponding monitoring is that it be taken into account in the clinical approaches of preventive medicine carried out for this species.

## CASE DESCRIPTION

**Anamnesis.** A 5 year-old female born under human care at Cali Zoo, who shared the enclosure with a male, reported multiple mating two months ago, reason why she was submitted to a clinical examination and ultrasound evaluation in order to determine if she was in state of gestation.

**Findings to the physical evaluation.** A clinical examination was performed by means of physical restriction, in which hirsute and seborrheic coat was observed as well as alopecia

and multifocal hypotrichosis in the labial commissure (Figure 1A) and in the dorsum towards the caudal with bilateral symmetrical distribution and scabs (Figure 1B). In addition to these lesions, it was reported that the animal presented signs of pain, presenting a marked kyphosis when moving, in addition to poor corporal condition.

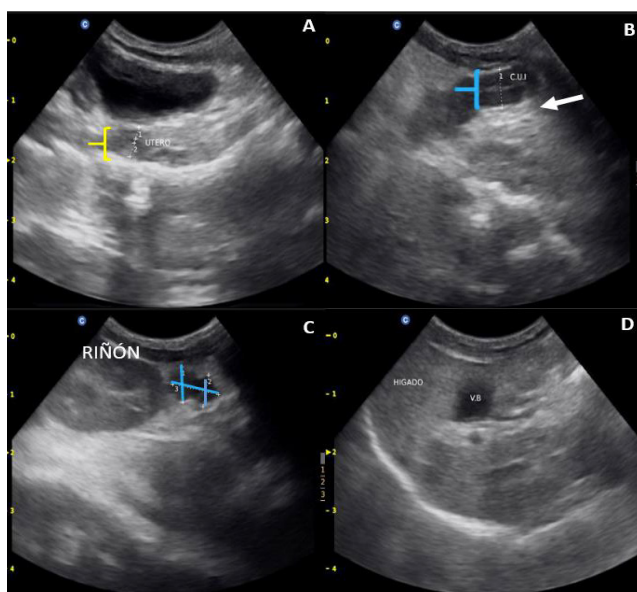


**Figure 1.** **A.** The blue arrow indicates alopecia at the corner of the mouth. **B.** The blue arrows indicate bilateral alopecia.

## Diagnostic Aids

A deep skin scraping was performed where a slight ectothrix affection was observed as well as the presence of abundant follicular cylinders, keratin, free yeasts and bacteria (coccobacillus).

**Ultrasonographic findings.** Using a multi-frequency micro convex probe, the edematous uterus was observed observing irregular borders (Figure 2A). The left ovary retained its oval size and shape, with an elongated, flattened and hyperechoic appearance, surrounded by an anechoic image delimited by a thin wall that resulted in a posterior reinforcement (Figure 2B) with the findings suggesting polycystic ovaries (Figure 2C). The liver was found to be preserved in size and increased echogenicity with respect to the comparison organ (kidney, Figure 2C) (Figure 2D). These findings suggested a fatty liver while the other organs evaluated did not present ultrasound changes indicating abnormality.



**Figure 2.** **A.** The yellow bracket points show a uterus with irregular borders. **B.** The blue bracket points to the hyper-echoic left ovary and the white arrow indicates the posterior reinforcement. **C.** The lines indicate the diameter of the ovarian cysts. **D.** Increased echogenicity of the liver is observed.

## Therapeutic plans

**Medical.** After the diagnosis, the decision was made to perform a chlorhexidine bath, which is

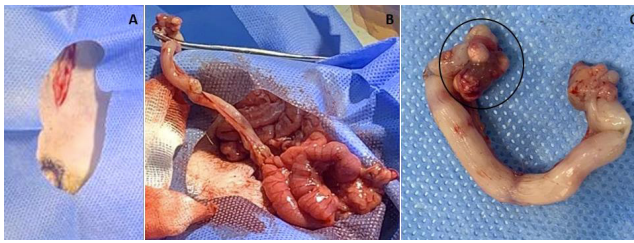
used as a bactericide and fungicide. In addition, a single dose of dipyrone, an analgesic drug used for the treatment of pain evidenced in its displacement, was administered. The animal was kept under observation until the surgical procedure.

**Surgical.** One month after the clinical and ultrasound examination, an ovariohysterectomy (OVH) was performed using the anesthetic protocol described in Table 2.

**Table 2.** Anesthetic protocol used during the procedure and medications used intra and post-surgery.

Effect	Via	Medication	Dosage (mg/kg)
Induction	IM	Ketamine	5*
		Dexmedetomidine	0.007*
		Midazolam	0.01*
Maintenance	Tracheal tube	Isoflurane	4% *
Antibiotic	IV	Cephalothin	30
AINE	SC	Meloxicam	0.2
Analgesic	PO	Tramadol	2
Antibiotic	PO	Amoxicillin + Clavulanic acid	15
AINE	PO	Meloxicam	0.1

The procedure was made along the ventral midline, with a sub-umbilical incision (Figure 3A) (7), up to the cranial edge of the pubis. The procedure was performed in a more ventral way with respect to the same procedure in canines and felines, since the anatomical distribution of their reproductive organs is more caudal, similar to the case of the mustelids. After the procedure, the uterus was exposed consisting of a short body from which two long, thin, V-shaped horns diverge (7, 8). By exposing the ovaries, it was possible to clearly identify the nodules, most markedly in the left ovary (Figure 3B-C). Subsequently, uterine blood vessel ligation and uterine horn trans flexion were performed to cut and remove. An excisional biopsy was taken from both ovaries and part of the left uterine horn with the specimens sent to the pathology laboratory and differentiated with suture material. Fluids at a rate of 3ml/kg/h, broad-spectrum antibiotic and an intraoperative NSAID were administered. Anesthetic recovery was achieved satisfactorily, without complications. The animal was treated with antibiotic for 7 days BID, NSAID and opioid analgesic for 3 days SID (Table 2).



**Figure 3.** **A.** Sub-umbilical incision. **B.** Uterine horn exposure. **C.** Circle indicates left ovary with multiple cysts.

**Hematology.** During the surgical procedure a 24 gauge intravenous catheter was inserted in

the cephalic vein with blood samples taken, in which according to the database of the ZIMS platform (Zoological Information Management System) the values obtained showed a decrease in hematocrit, with hemoglobin and red blood cells in normal ranges, but anisocytosis, polychromasia and reticulocyte count above the range. All values consistent with regenerative type anemia.

**Blood chemistry showed an increase in the BUN.** Creatinine and total proteins ratio associated to hyperglobulinemia. Additionally, an increase in total bilirubin and alkaline phosphatase was reported (Table 1).

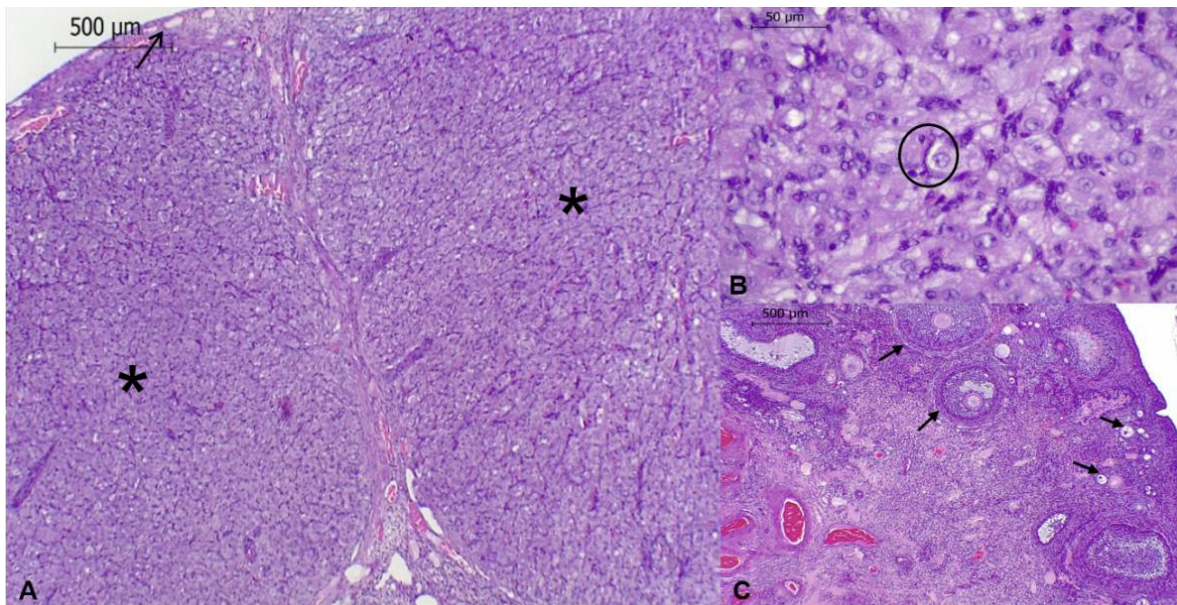
**Table 1.** Hematology and blood chemistry results

Examination	Test	Results	Reference Values
<b>Hemogram</b>	<b>Hto</b>	<b>25%</b>	25.6 - 54.0
	Hb	8.5 g/dl	7.7 - 16.6
	RBC	$5.94 \times 10^6$	4.96 - 12.00
	MCV	42fL	36.0 - 52.6
	MCHC	34g/dl	26.6 - 36.8
	<b>Reticulocyte count</b>	<b><math>11.8 \times 10^3</math> cells/<math>\mu</math>L</b>	1.1-3.8
	Plaquetas	$779 \times 10^3$ cells/ $\mu$ L	39 - 885
	Bands %	$9.6 \times 10^3$ cells/ $\mu$ L	1.6 - 11.3
	Band Count	74%	26.4 - 85.0
	Metamyelocyte %	<b><math>7.1 \times 10^3</math> cells/<math>\mu</math>L</b>	1.35-6.51
	Metamyelocyte Count	1%	0.0 - 69.9
	Lymphocytes %	$0.1 \times 10^3$ cells/ $\mu$ L	0.01-0.21
	Lymphocyte Count	0%	
	Monocyte %	$0 \times 10^3$ cells/ $\mu$ L	
	Monocyte count	25%	11.4 - 72.2
	Eosinophil %	$2.4 \times 10^3$ cells/ $\mu$ L	0.6-3.38
	Eosinophil Count	0%	0.0 - 10.0
<b>Blood Chemistry</b>	Glucose	$0 \times 10^3$ cells/ $\mu$ L	0.0-0.5
	BUN	0%	0.0 - 5.7
	Creatinine	$0 \times 10^3$ cells/ $\mu$ L	0.0-0.3
	Glucosa	63mg/dl	46 - 183
	BUN	26 mg/dl	14.6 - 43.6
	Creatinina	0,3mg/dl	0.3 - 1.9
	<b>BUN: Creatinine ratio</b>	<b>102</b>	16.0 - 67.2
	ALT	69 U/L	35 - 278
	AST	81 U/L	37 - 162
	<b>Alkaline Phosphatase</b>	<b>113 U/L</b>	4 - 56
	<b>Total protein</b>	<b>8.2 g/dl</b>	4.8 - 7.9
	<b>Albumin</b>	<b>18 g/dl</b>	20 - 44
	Ck	121 U/L	32 - 1,101
	Ca	8.4 mg/dl	8.0 - 11.0
P	8.3 mg/dl	2.9 - 8.4	
<b>Total Bilirubin</b>	<b>0.7mg/dl</b>	0.0 - 0.5	
Cholesterol	378 mg/dl	190 - 717	
<b>Globulin</b>	<b>6.4 g/dl</b>	2.1 - 5.0	

**Results of the histopathological evaluation.**

The left ovary (with 2-0 vicryl suture) measured 1.3cm longer and presented multiple nodulations of firm consistency and yellowish color, the largest of which had a diameter of 4mm. The right ovary (without suture) was 1cm larger in diameter. In all the cuts of the left ovary, a well-defined and unencapsulated multi-lobed cortical neoplasm was observed, partially compressing the parenchyma and adjacent stroma. It is composed of islets of

polygonal cells that are distributed among fine collagen septa. Neoplastic cells have wide and finely vacuolated cytoplasm with ovoid nuclei, moderately chromatic and homogeneous, which do not exhibit atypia or mitosis. And in the right ovary, an ovarian parenchyma with follicles in different stages and a corpus luteum was found, and no significant lesions were observed in the fragments of ampulla and adjacent horn. (Figure 4).



**Figure 4.** **A.** The black arrow indicates the displacement of the parenchyma due to the neoplasm (\*). H&E staining, 40X **B.** The circle shows the typical characteristics of neoplastic cells. H&E Staining 400X **C:** The arrows indicate the follicles in different stages. H&E stain 400X.

**Evolution.** The patient was able to recover satisfactorily from the surgical procedure and the hematology and blood chemistry follow-up values performed a month and a half after the surgery, were in normal ranges. In addition, the animal recovered its normal position as well as the totality of its coat in addition to achieving weight gain.

**DISCUSSION**

The description of ovarian neoplasms in small wild carnivores is scarce, they are usually considered an incidental finding and are usually diagnosed in animals over 5 years of age (9). However, in related species such as domestic carnivores it has been determined that the

degree of incidence of ovarian tumors does not exceed 3.7% and in the specific case of gonadal and stromal cell tumors they account for 34% of all ovarian tumors (10,11). In this case, it was possible to determine the presence of a Luteoma, a tumor of the stroma's sexual cords, which originates from specialized cells of the ovary in charge of the production of estrogens and progesterone (12). Luteomas are of benign biological origin, generally present unilaterally, a finding consistent with what has been observed in this case. They are usually lobe-like in appearance, firm in consistency and have a yellowish-white coloration on the surface (10,13). This neoplasm may be hormonally active, resulting in abnormal reproductive behaviors such as persistent anestrus, intermittent or continuous estrus

and/or masculinization (14,15,16). In this case, the patient presented reports of constant and frequent mating before the diagnosis, findings consistent with what was previously reported.

Stromal tumors of the sexual cord in canines are associated with signs of hyperestrogenism, such as endocrine alopecia, myelo suppression and non-regenerative anemia, leukopenia, thrombocytopenia, hemorrhagic diathesis and cystic and/or pyometra endometrial hyperplasia (14,15). Some of these signs were observed in the patient. Other differential diagnoses considered, besides multifocal alopecia associated to hyperestrogenism and polycystic ovaries, were other ovarian and uterine tumors such as leiomyoma and teratoma, which are frequently reported in domestic carnivores and ferrets, often with unilateral presentation (7,10). Previously, uterine leiomyomas have been diagnosed in multiple meerkats in the Cali Zoological Foundation. The signs of abdominal pain described in the patient could be associated with uterine mass or changes. Finally, the hematological alterations found (increase of BUN and total proteins), were related to a hyperglobulinemia due to chronic inflammation.

The increase in alkaline phosphatase and total bilirubin observed in blood chemistry was associated with increased liver echogenicity, a finding suggestive of fatty liver (7), which is a common condition in meerkats maintained under human care (4). The etiology of this condition is associated with high-fat diets and sedentarism, which in the case of related species such as mustelids are related to the high metabolic capacity to rapidly mobilize visceral fat and polyunsaturated fatty acids, thus generating hepatic lipidosis (17), and in turn an increase in bilirubin. Additionally, there were signs of a regenerative anemia, which is reaffirmed with the anisocytosis and polychromasia reported in the hemogram. Reported cases of Luteoma in dogs have been found after analyzing blood chemistry and finding an increase in alkaline phosphatase and hypercholesterolemia (18).

A key diagnostic tool in this case was the ultrasound scan, through which it was possible to determine the presence of structures compatible with ovarian cysts. However, histopathology was conclusive for the definitive diagnosis. In conclusion, literature reports regarding anatomy and reproductive pathologies presented in meerkats are scarce, which is why a comparison of the evolution and clinical signs of specific ovarian affections and their possible consequences is undetermined.

It is necessary to have knowledge on the anatomy and reproduction physiology of species in order to understand the possible disorders of the reproductive tract and its associated organs. Likewise, knowing the similarities with other species will allow to extrapolate some findings, as well as the evolution of their disease patterns. Finally, this report sheds light on ovarian neoplasia in a Meerkat that showed signs associated with hypoestrogenism, which highlights the importance of ultrasound evaluation as part of the preventive medicine program for animals in captivity, which is an accessible and non-invasive diagnostic technique that allows determining these reproductive problems.

### **Conflict of interest**

The authors declare that no conflict of interest exists with the publication of this manuscript.

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