

Hiperaldosteronismo, Feocromocitoma e Abordagem de Tumores Adrenais

Prof. Dr. Álan Gomes Pöppel

Médico Veterinário - UFRGS
Residência em Clínica e Cirurgia de Pequenos Animais - HCV/UFRGS
Mestrado em Fisiologia - Laboratório de Metabolismo e Endocrinologia Comparada ICBS/UFRGS
Doutorado em Ciências Veterinárias - PPGCV/UFRGS
Atuações na Society for Comparative Endocrinology (SCE) e European Society of Veterinary Endocrinology (ESVE)
Sócio Fundador e Diretor Executivo da Associação Brasileira de Endocrinologia Veterinária - ABEV
Fundador e Consultor da Equipe PetEndocrine
Professor Adjunto, Departamento de Medicina Animal, UFRGS
Professor do Programa de Pós-Graduação em Ciências Veterinárias FaVet/UFRGS
Coordenador do Serviço de Endocrinologia e Metabologia, e do Programa de Ações em Endocrinologia Veterinária HCV/UFRGS.



1

HIPERALDOSTERONISMO

Síndrome de Conn

2

Síndrome de Conn

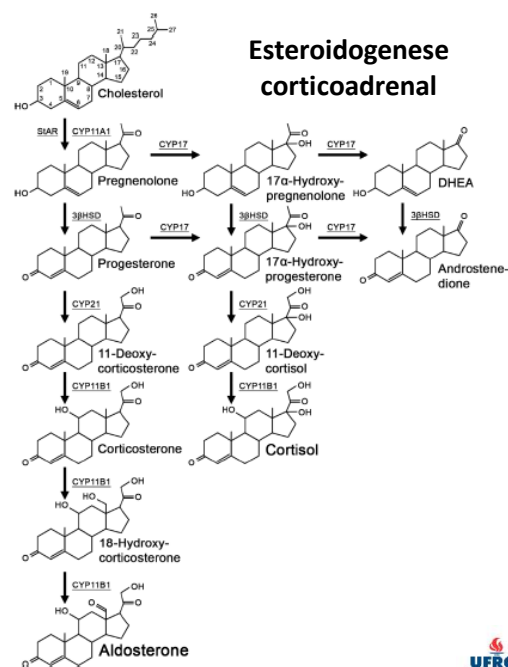
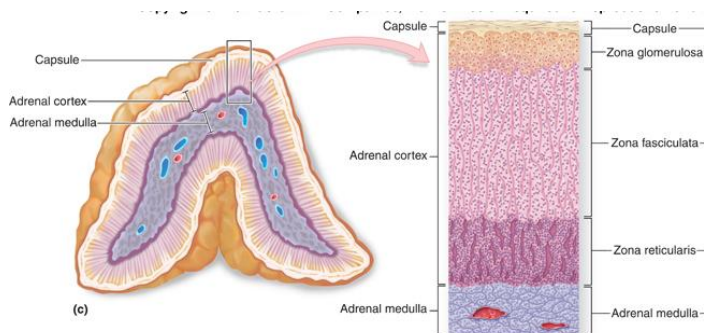
- Caracterização do “Aldosteronismo primário” previamente conhecido como “nefrite perdutora de potássio” (1954)
- Em 1964 Dr. Jerome Conn já tinha 145 casos documentados, sugerindo a doença como a causa de hipertensão primária em até 20% dos pacientes, revisando após para estimativa de 10%
- **Atualmente:**
- Hiperaldo representa ~6% causas de hipertensão
- 11% dos casos resistentes a terapia



3

Aldosterona

- Baixa expressão de 17-hidroxilase na zona glomerulosa do córtex adrenal
- Produção local no coração, cérebro e vasos

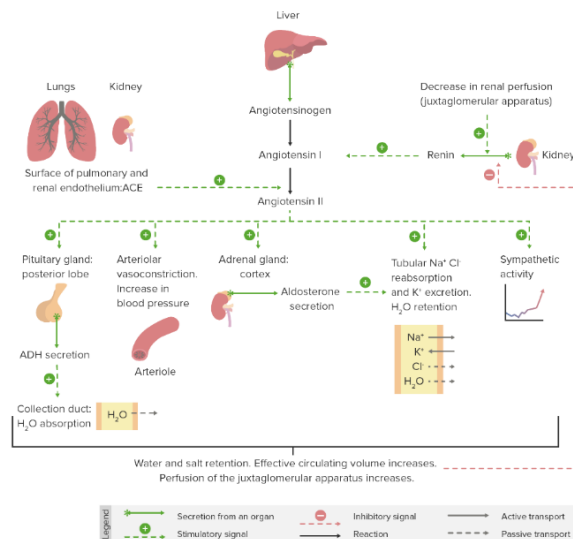
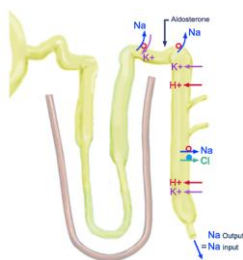
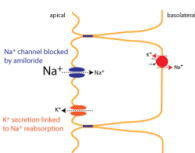
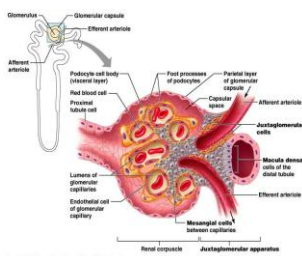


4

Aldosterona

- Secreção estimulada por:

- ✓ **Angiotensina II**
- ✓ **K**
- ✓ ACTH
- ✓ Peptídeo natriurético
- ✓ Neurotransmissores

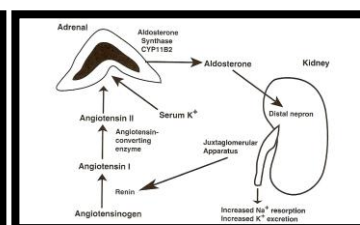
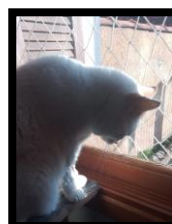


Em excesso:

- ✓ > retenção Na, Cl e HCO₃
- ✓ > excreção K⁺ e H⁺



Hiperaldosteronismo Felino



- Doença **emergente**
- Considerada a espécie doméstica mais predisposta à S. Conn
- Potencialmente é uma doença subdiagnosticada, prevenindo que muitos gatos sejam diagnosticados e eventualmente curados (como em humanos)

• Causas para subdiagnóstico:

- ✓ Hipertensão e Hipocalemia são complicações frequentes da DRC
- ✓ Muitos centros ainda não aferem PA na rotina
- ✓ O Hiperaldo pode ser a CAUSA da DRC!



Etiologia do “HiperALDO” Primário Felino

Supressão de atividade Renina Plasmática

- Adenomas corticoadrenais
- Adenocarcinomas corticoadrenais
- ✓ Invasão local, metástases
- Hiperplasia bilateral (idiopática)

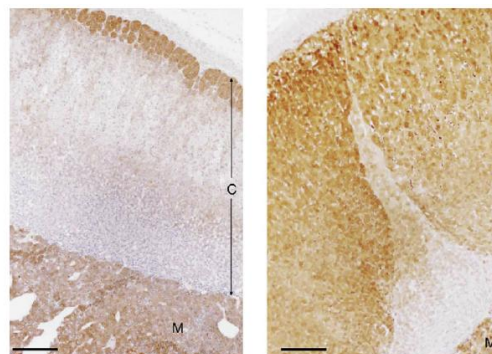
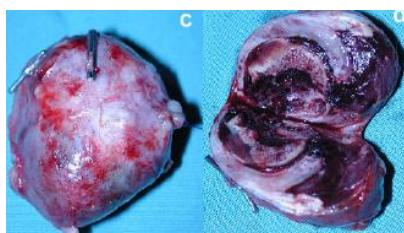


Fig. 2. Histologic sections of adrenals stained with neuron-specific enolase (NSE). In the healthy cat (left), the staining of the cortex (C) is mainly confined to the zona glomerulosa. In the cat with primary hyperaldosteronism (right), the cortex consists of multiple hyperplastic nodules, staining positively for NSE. Staining of the adrenal medulla (M) is similar in the 2 sections. Bar = 200 μm .¹

Kirkwood et al., 2019; Kooistra, 2020



7

Manifestações Clínicas

- **Miopatia Hipocalêmica**
- ✓ Ventroflexão cervical (ausência lig. nugal)
- ✓ Fraqueza
- ✓ Dificuldade pular
- ✓ Postura plantígrada?



8

Manifestações Clínicas

- **Miopatia Hipocalêmica (ventroflexão cervical)**



Vesgolino, MC, 13 anos, suspeito Hiperaldó...

Na > 180 mmol (ref. 150-165)

K = 2,7 mmol/L (ref. 3,5-5,8)

Vídeos gentilmente cedidos Dra. Alejandra Garcia e Denise Iparraguirre



9

Manifestações Clínicas

- **Tetraparesia e ventroflexão cervical**



Vídeos gentilmente cedidos MV. MSc. Gabireli Américo

10

Manifestações Clínicas

- Hipertensão arterial sistêmica
 - ✓ Descolamento retina,
 - ✓ Cegueira súbita
 - ✓ Hemorragia iridal ou retinianas,
 - ✓ AVEs,
 - ✓ Epistaxe



11

Manifestações Clínicas

- Estudo retrospectivo
- 29 gatos...

Case Series



Surgical findings and outcomes after unilateral adrenalectomy for primary hyperaldosteronism in cats: a multi-institutional retrospective study

Journal of Feline Medicine and Surgery
1-7
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journalsPermissions
DOI: 10.1177/1098612X221135124
journals.sagepub.com/home/jfm
This paper was handled and processed
by the European Editorial Office (EFM)
for publication in JFMS

SAGE

Sara Del Magno¹, Armando Foglia¹, Matteo Rossanese², Vincenzo Montinaro³, Veronica Cola¹, Luciano Pisoni¹, Diego Rossetti⁴, Matteo Cantatore⁵, Benito De La Puerta⁶, Stefano Nicoli⁷, Guido Pisani⁸, Francesco Collivignarelli⁹, Giorgio Romanelli¹⁰, Filippo Cinti¹¹, Matteo Olimpo¹² and Federico Fracassi¹

Table 1 Clinical signs of 29 cats with confirmed or highly suspected primary hyperaldosteronism

Clinical signs	Cats
Weakness/lethargy	20 (69)
Neck ventroflexion	17 (59)
Gastrointestinal signs	10 (33)
Polyuria/polydipsia	7 (22)
Blindness	2 (7)

Data are presented as n (%)

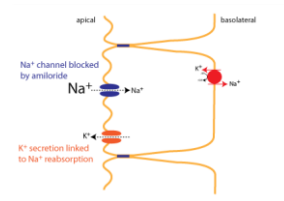


12

Diagnóstico HiperALDO Primário

• Sinais clínicos,

- Palpação massa adrenal?
- Ultrassonografia abdominal
- Avaliação **Na** (costuma estar normal) e **K↓**
- Proteinúria?
- Aldosterona **↑**
- Renina **↓**



NA PRÁTICA, documentação de Hiperaldosteronemia (>500 pmol/L) + tumor adrenal + Hipocalemia +/- Hipernatremia e Hipertensão são suficientes para diagnóstico



13

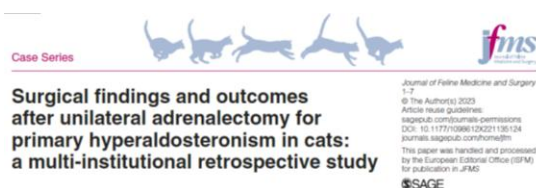


Table 2 Clinicopathological results of 29 cats with confirmed or highly suspected primary hyperaldosteronism

Parameter	No. of cats with parameters measured	No. of cats with increased parameters	No. of cats with decreased parameters	Range	Mean
Haematocrit (%)	27	0	9	23–38	30
Platelets (mm ³)	27	2	0	159,000–768,000	338,000
WBCs (mm ³)	22	2	2	7790–16,400	9370
K (mEq/l)	29	0	29	2.06–3.2	2.6
Na (mEq/l)	26	8	0	150–168	154
Creatinine (mg/dl)	26	6	0	0.8–6.5	1.5
Urea (mg/dl)	25	13	0	30–481	23
CK (U/l)	21	15	0	122–20,100	2464
Aldosterone (pmol/l)	24	24	0	594 to >5000	
USG	21	2	18	1008–1050	1022
Proteinuria	15	8	0	0.15–3	0.9
PT (s)	7	1	0	8.3–12.3	10.2
aPTT (s)	7	0	1	14.7–31.9	15.8

WBCs = white blood cells; CK = creatinine kinase; USG = urine specific gravity; PT = prothrombin time; aPTT = activated partial thromboplastin time



14

Diagnósticos Diferenciais para HIPOCALEMIA

- Reduzido aporte
 - **Inapetência, Anorexia**
 - Dieta restrita em K
 - Fluidos IV deficientes em K
- Translocação (LEC → LIC)
 - **Alcalemia**
 - **Administração insulina**
 - Cetoacidose diabética
 - Administração bicarbonato
 - Hipocalemia periódica (Burmese)
 - Hipotermia
 - Estimulação por catecolaminas
- Perdas GI
 - **Vômitos**
 - **Diarréia**
 - Má-absorção
- **Perdas renais**
 - Poliúria
 - DRC
 - IRA
 - Uso diuréticos (alça ou tiazídicos, ATB)
 - **Hiperaldosteronismo 1° x 2°**
 - Acidose renal tubular
- Doenças endócrinas
 - Hipertireodismo
 - Síndrome de Cushing
- Outras doenças
 - Insuficiência hepática
 - Hipertensão portal
 - ICC



15

Fatores Associados ao Sub-Diagnóstico!

- Considerado raro mas não é
- Não mensuração da PAS na rotina clínica
- Assumpção dos veterinários que o K baixo e PAS elevada é resultado de DRC!
- **ALDOSTERONA elevada induz DRC!!**
(Efeito indutor de fibrose vascular especialmente nos rins)
- **Avaliar relação Aldo/Renina:**
 - Diferenciar Hiperaldo e aumento PAS 2° a DRC
 - Diferenciar aumento PAS 2° a Hiperaldo 1° em um gato com DRC

Primary Hyperaldosteronism in Cats

An Underdiagnosed Disorder

Hans S. Kooistra, DVM, PhD



16

Ultrasonographic evaluation of adrenal gland size in two body weight categories of healthy adult cats

Laura Pérez-López¹, Ana María Wägner^{1,2}, Pedro Saavedra³, Jose Raduan Jaber⁴ and Carlos Melián^{1,5}

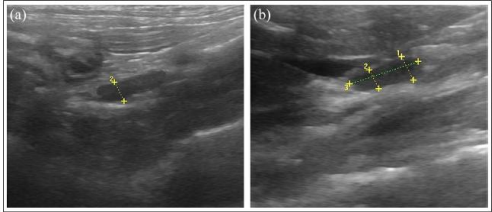


Figure 1 (a) Left and (b) right adrenal glands of a 5-year-old neutered male Siamese cat that weighed 3.7 kg. (a) Measurement of the maximum dorsoventral thickness (3.5 mm) of the left adrenal gland; (b) measurement of the maximum dorsoventral thickness (3.6 mm) of the right adrenal gland

	Lower limit (mm)	Upper limit (mm)	n*
Cats ≤4.0 kg	2.4 (2.2–2.6)	3.9 (3.7–4.1)	26
Cats >4–8 kg	2.6 (2.4–2.8)	4.8 (4.6–5.1)	52

*Number of adrenal glands included to calculate the reference interval

Article
Ultrasonographic Detected Adrenomegaly in Clinically Ill Cats: A Retrospective Study

João Oliveira¹, Maria Joana Dias^{1,2,3}, Ana Paula Fontes⁴, Ryane E. Englar⁵, Gonçalo Vicente¹, Rui Lemos Ferreira¹, Sara Galac⁶ and Rodolfo Oliveira Leal^{1,2,3,*}

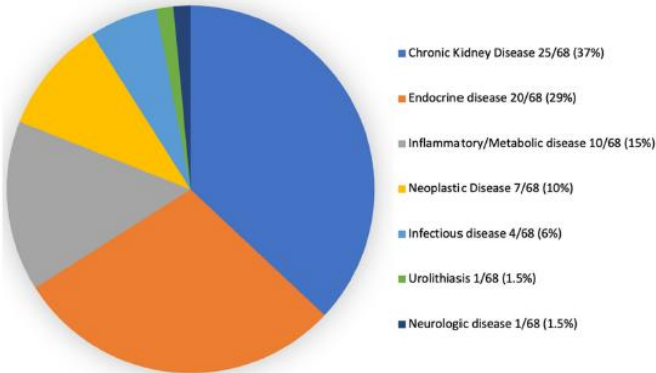


Figure 3. Final diagnosis in clinically ill cats noticed with adrenomegaly.

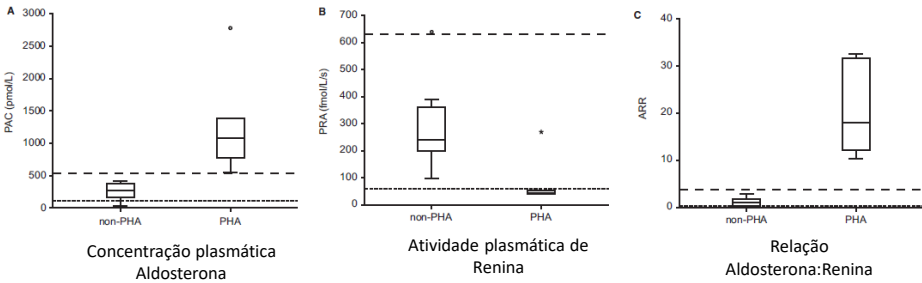
Teste de Supressão por Fludrocortisona

- Dose 0,05 mg/kg BID por 4 dias – [Relação aldosterona:creat urinária] antes e após
- Risco de piora da hipocalcemia (frequente) e hipertensão

J Vet Intern Med 2013;27:1493–1499

Evaluation of the Oral Fludrocortisone Suppression Test for Diagnosing Primary Hyperaldosteronism in Cats

S.C. Djajadiningrat-Laanen, S. Galac, M.H. Boevé, S.A.E.B. Boroffka, E.C. Naan, J. IJzer, and H.S. Kooistra



19

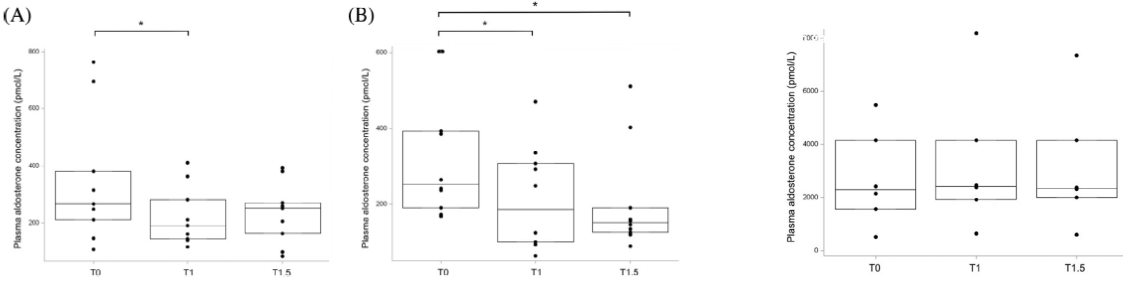
Received: 8 December 2022 | Accepted: 10 March 2023
DOI: 10.1111/jvim.16889

STANDARD ARTICLE

Journal of Veterinary Internal Medicine American College of Veterinary Internal Medicine

Evaluation of oral telmisartan administration as a suppression test for diagnosis of primary hyperaldosteronism in cats

Virginie Fabrés^{1,2} | Renaud Dumont³ | Mélanie Garcia⁴ | Dan Rosenberg⁴ | Benoit Rannou^{5,6} | Maxine Kurtz¹ | Ghita Bencheikroun^{1,7}



(A) 1 mg/kg, (B) 2 mg/kg em gatos saudáveis

- Avaliar % redução da aldosterona após 90 minutos da administração de Telmisartana (Bloqueador receptor Angio II)



20

Tratamento

- **MANEJO HIPERTENSÃO**

- ✓ Anlodipina 0,625-1,25 mg/gato (sid/bid)
- ✓ Espironolactona 2-4 mg/kg (sid a bid)

• SUPLEMENTAÇÃO K

- ✓ IV <0,5mmol/Kg/h)
- ✓ Oral (Gluconato de Potássio 2mmol bid)

- **ADRENALECTOMIA**

Serum potassium concentration (mmol/l)	Required potassium (mmol) per litre of fluids
< 2.0	80
2.1–2.5	60
2.6–3.0	40
3.1–3.5	30
>3.5, < 5.0	20



21

[illegible]

Case Series

Surgical findings and outcomes after unilateral adrenalectomy for primary hyperaldosteronism in cats: a multi-institutional retrospective study

Journal of Feline Medicine and Surgery
1-7
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journalsPermissions
DOI: 10.1177/10981736231136124
journals.sagepub.com/home/fms
This paper was handled and processed by the European Editorial Office (EFMO) for publication in JFMS
SAGE

- Tumores variaram 1-4,6 x 0,4-3,8 cm
- Invasão vascular em 5/29 (4 cava e 1 renal)
- Média tempo cirurgia 57 min
- 1 caso hemorragia pós-trombectomia
- 1 óbito PO suspeita CID
- Hospitalização média 4 dias
- 97% sobreviveram após alta
- Normalização HAS 21/23 gatos
- Normalização Hipocalcemia 24 gatos < 3 meses
- Sobrevida média 1082 dias

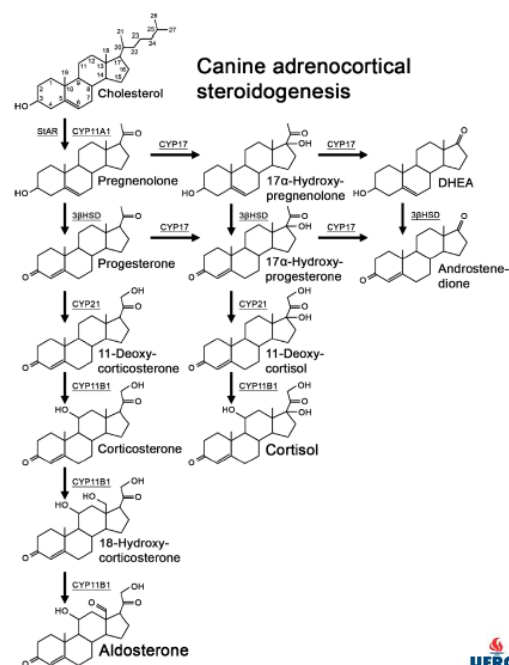
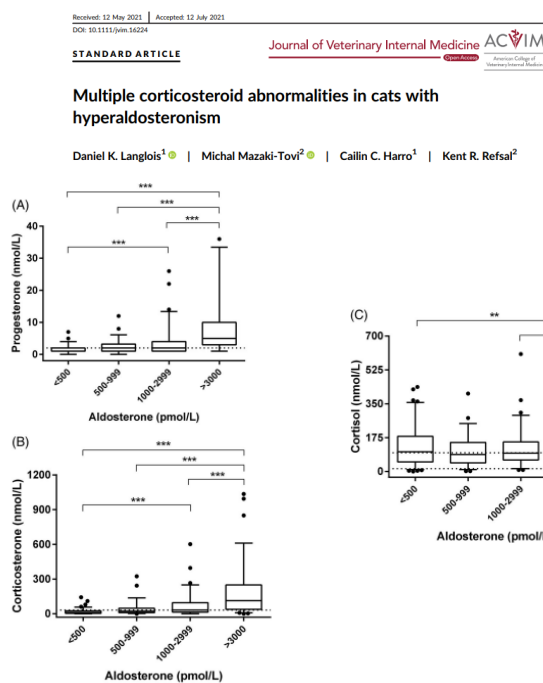
22

Hiperaldo, nem sempre tão tranquilo...

- Eventualmente associado a **Hiperprogesteronemia**
- **Clínica similar ao Hiper cortisolismo Felino**
- **Associação com DM**
- Pu/Pd, Pf, Seborréia oleosa, falha crescer pelos, alopecia, neuropatia diabética, abdome abaulado...



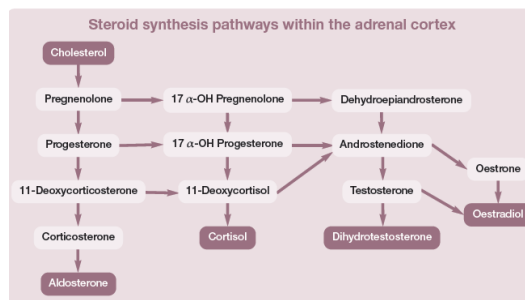
23



24

Primary Functioning Adrenal Tumors Producing Signs Similar to Hyperadrenocorticism Including Atypical Syndromes in Cats

Nicki Reed and Daniëlle Gunn-Moore



- > Freq machos castrados
- Clinica de HAC + Presença de tumor adrenal + Testes hormonais negativos....
- Dosagem de **progesterona basal**
- Estímulo por ACTH (5 mcg/kg IV) dosando progesterona, 17-oh-progesterona, estrógenos, testosterona e androstenediona após ACTH...

FEOCROMOCITOMA

Received: 22 November 2021 | Revised: 19 May 2022 | Accepted: 24 May 2022

DOI: 10.1002/vrc2.426

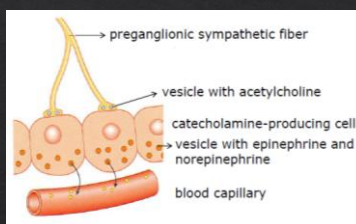
VetRecord
CaseReports**CASE REPORT**

Companion or pet animals

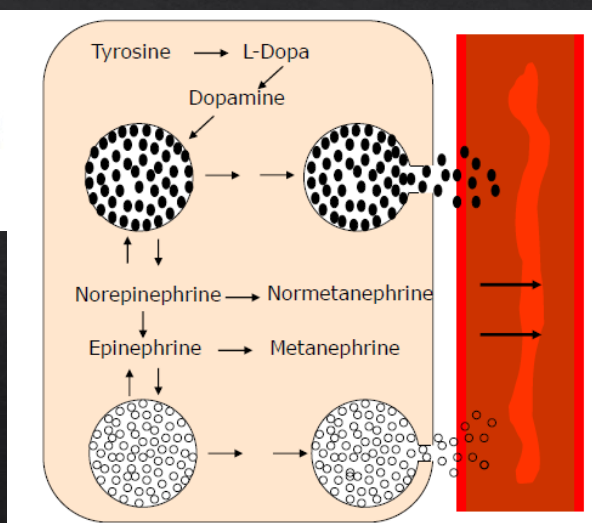
Hypocortisolism in a dog caused by bilateral pheochromocytomaElber Alberto Soler Arias¹ | Sara Galac² | Santiago Teyssandier³¹Facultad de Ciencias Veterinarias, Hospital Escuela, Universidad de Buenos Aires, Buenos Aires, Argentina²Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands³Facultad de Ciencias Agrarias y Veterinaria, Universidad del Salvador, Buenos Aires, Argentina**Correspondence**Elber Alberto Soler Arias, Facultad de Ciencias Veterinarias, Hospital Escuela, Universidad de Buenos Aires, Buenos Aires, Argentina.
Email: mveterinario@yahoo.es**Abstract**

We present a 12-year-old French bulldog with muscle weakness, epigastric pain, weight loss, high systolic blood pressure and cardiac arrhythmias. Physical and laboratory examination revealed no abnormalities. On a computed tomography scan, severely enlarged adrenals were found, and endocrine and biochemical evaluations excluded hypercortisolism and hyperaldosteronism. Urinary metanephrine and normetanephrine/creatinine ratios were elevated, compatible with a diagnosis of pheochromocytoma. Symptomatic treatment with phenoxybenzamine was started and resulted in normalisation of a systolic blood pressure and reduction of arrhythmias. However, the onset of anorexia, vomiting and clinical deterioration prompted exploration of the adrenocortical reserve through an adrenocorticotrophic hormone stimulation test, which confirmed glucocorticoid deficiency. Mineralocorticoid deficiency was ruled out by normal plasma aldosterone concentration and renin activity. Finally, an elevated endogenous plasma adrenocorticotrophic hormone concentration defined the primary origin of the hypocortisolism. Clinical resolution occurred with prednisolone supplementation. This is the first report of hypocortisolism in a dog caused by a bilateral pheochromocytoma.

29

Catecolaminas: síntese, metabolismo e secreção

- ◊ 70% Adr e 30% Nora em saudáveis
- ◊ Feo predomínio Nora
- ◊ Nora → Normetanefrina
- ◊ Adrenalina → Metanefrina



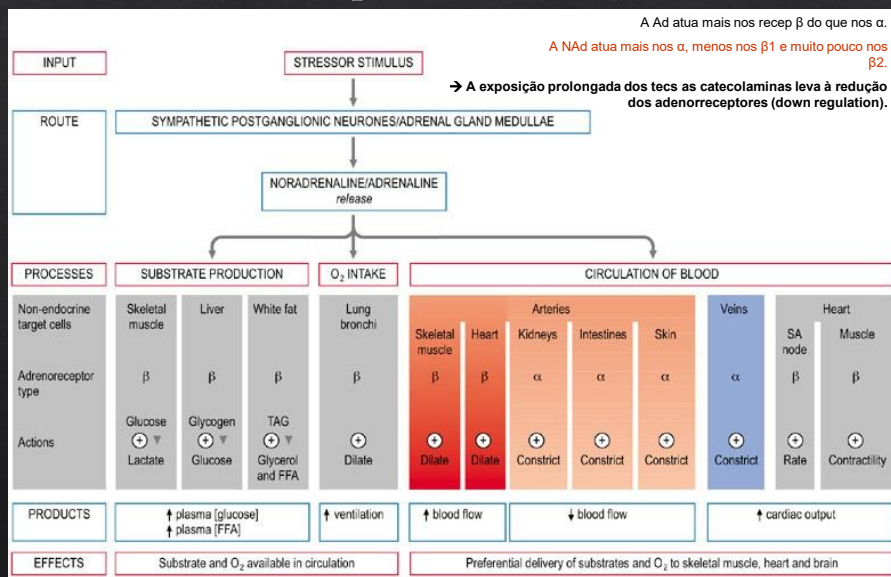
30

Estresse → Resposta de “Medo, Luta e/ou Fuga” (*Fright, Fight, Flight*)



31

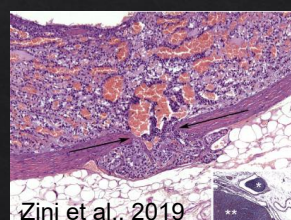
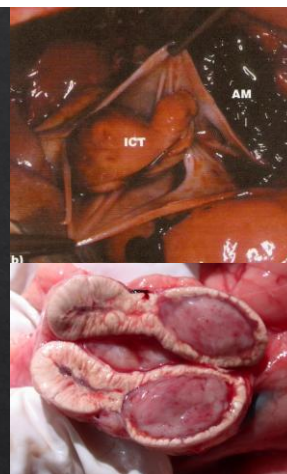
Cães saudáveis → 70% catecolaminas estocadas é adrenalina 30% nora
(Feo predomínio Nora)



32

Feocromocitoma

- ◊ Média idade 10 anos (> 7 normalmente), sem predileção sexual ou racial,
- ◊ Felinos (DSH) 7-18 anos
- ◊ Taxas de 15-30% de metástases e >40% de invasão
- Prevalência diag. pós-mortem:
 - ◊ ➔ Cães 1,7%
 - ◊ ➔ Gatos 0,2%
- Prevalência diag. pós-adrenalectomia Incidentaloma ➔ ~25%



33

Sinais Clínicos

Leves a graves! Agudos, crônicos ou episódicos **DEPENDENDO**
Se a secreção é intermitente ou contínua e do tipo de catecolamina

- ◊ **Inespecíficos** ➔ anorexia, perda peso, letargia, hipertermia / FREQUENTEMENTE ASSINTOMÁTICO
- ◊ **Cardiorespiratórios** ➔ taquicardia, arritmias, taquipneia, ofegação, sangramentos oculares/nasais, cegueira, colapsos, mucosas pálidas, ascite (trombos), HAS
- ◊ **Neuromusculares** ➔ fraqueza, ansiedade, convulsões, tremores, ataxia, insônia, midríase, paresia/paralisia (trombos)
- ◊ **Mistos** ➔ Pu/Pd, vômitos, diarreia, dores abdominais (2ª necrose ou sangramento tumoral)



34

Pathologic and Cardiovascular
Characterization of Pheochromocytoma-
Associated Cardiomyopathy in Dogs

Veterinary Pathology
2015, Vol. 52(2) 338-343
© The Author(s) 2014
Reprints and permission:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/0300985814533805
vet.sagepub.com

E. F. Edmondson¹, J. M. Bright², C. H. Halsey³, and E. J. Ehrhart¹

Abstract
Pheochromocytoma-associated catecholamine-induced cardiomyopathy is a well-known entity in man, nonhuman primates, and mice but has not been described in dogs. In this retrospective study, 9 dogs were identified with pheochromocytomas and concurrent cardiovascular pathology observed histologically ($n = 6$), echocardiographically ($n = 4$), and/or electrocardiographically ($n = 5$). Cardiac lesions included multifocal cardiomyocyte necrosis with contraction bands, cardiomyocyte degeneration, myocardial hemorrhage, lymphohistiocytic myocarditis, and interstitial fibrosis. Clinical procedures, including electrocardiographic and echocardiographic examinations, Doppler blood pressure measurement, and auscultation, were available for 5 dogs and consistently revealed concentric or mixed (eccentric and concentric) ventricular hypertrophy. Additional changes observed included arrhythmias, systemic hypertension, and heart murmurs. The myocardial lesions observed in this series of dogs are similar to those observed in humans with pheochromocytoma-associated catecholamine-induced cardiomyopathy. Since the clinical manifestations of catecholamine-induced cardiac disease are amenable to medical treatment, recognition of this cardiomyopathy has the potential to reduce morbidity and mortality in dogs with pheochromocytoma.

Topics in Companion An Med 53–54 (2023) 100777

Research Article

Pathological Aspects and Immunohistochemical Evaluation of Troponin C in the Cardiovascular System of Dogs With Pheochromocytoma

Fernando F. Argenta^a, Mónica Slaviero^{a,b}, Lauren S. de Mello^a, Joanna V.Z. Echenique^a, Alexia A. Zorzan^a, Fernanda G. Cony^a, Marcelle B. Bandinelli^a, Márcio B. de Castro^a, Saulo P. Pavarin^a, David Driemeier^a, Luciana Sonne^a



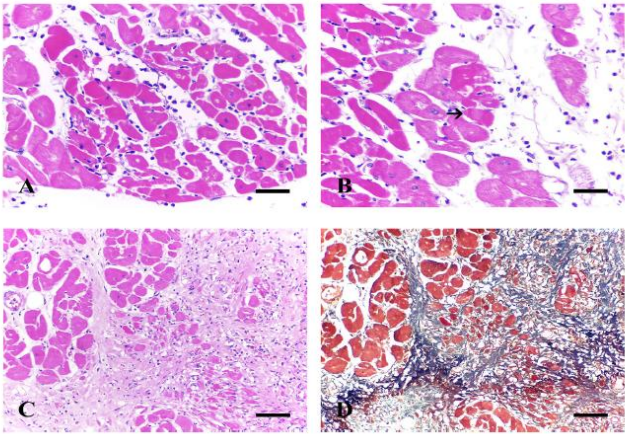


Figure 2. Dog, heart. Histological aspects of the left ventricle of dogs with pheochromocytoma. (A) A focally extensive area of necrosis and cardiomyocyte degeneration, characterized by cell retraction, hyper eosinophilia, homogeneous cytoplasm with loss of striations and nucleus with condensation of chromatin, and fragmentation or nuclear absence. In addition, moderate interstitial inflammatory infiltrates consisting of lymphocytes, plasma cells and macrophages was visualized. HE. Bar, 120 μ m. (B) Cell fragmentation, vacuolar degeneration and contraction bands in cardiomyocytes (arrow). HE. Bar, 60 μ m. (C) Intense multifocal coalescent interstitial fibrosis. HE. Bar, 120 μ m. (D) The deposition of fibrous connective tissue was observed by the intense blue staining of the Masson's trichrome. Mfr. Bar, 120 μ m.

HAS e Hipertrofia cardíaca

- ◈ Fatores determinantes de crises HAS:
- ◈ Mecânicos: pressão na adrenal
- ◈ Drogas: corticoides, inibidores MAO, antidepressivos tricíclicos, B-bloqueador, metoclopramida, opioides, clorpromazina, quimioterápicos, simpaticomiméticos)
- ◈ Outros: dor, estresse emocional, exposição ao frio, alimentos ou bebidas com tiramina (metab. Tirosina - banana, carnes, peixes, queijos, álcool)
- ◈ **Até 325 mmHg, porém só documentada em 50% casos!!!**



Marcasso et al., 2011



37

Diagnóstico

- ◈ **Dificuldades para diagnóstico definitivo:**
 - US baixa sensib/espec. para diferenciar Feo
 - CT >sens p/ planejamento cirúrgico (sens. 92% invasão vascular)
 - Exames gerais sem utilidade Diagnóstica
 - Limitações quanto à valores de referência e custo para mensuração de catecolaminas e seus metabólitos (**normetanefrina**, metanefrina, ác vanililmandélico)
 - Influências de estresse, baixa t1/2
 - CAAF (RISCOS!!)
 - Excluir outros tumores adrenais (TSpBDD, Aldosterona e Na:K, Horm. Sexuais?)



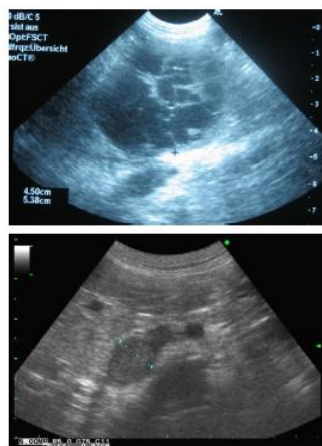
38



University of
Zurich

Clinic for Small Animal Internal Medicine

Ultrasonographic findings in 3 dogs with PHEO



39

Qto > relação normetanefrinas:creatinina urinária > chance de Feo

Journal of Veterinary Internal Medicine

Open Access



J Vet Intern Med 2015;29:597-602

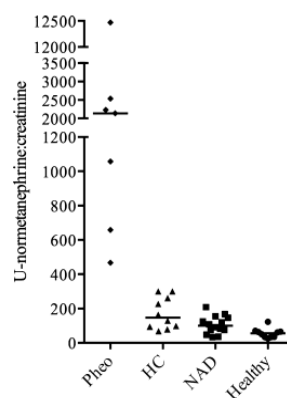
Urinary and Plasma Catecholamines and Metanephrines in Dogs with Pheochromocytoma, Hypercortisolism, Nonadrenal Disease and in Healthy Dogs

E. Salesov, F.S. Boretto, N.S. Sieber-Ruckstuhl, K.M. Rentsch, B. Riond, R. Hofmann-Lehmann, P.R. Kircher, E. Grouzmann, and C.E. Reusch

Table 1. Ranges and median values of urinary catecholamines and metanephrines to creatinine ratios, plasma catecholamines and plasma-total and free metanephrines in dogs with pheochromocytoma (PC), with hypercortisolism (HC), with nonadrenal diseases (NAD), and in healthy dogs.

Parameter	PC	HC	NAD	Healthy
U-norepinephrine : creatinine	8.0-2687.0 (44.0) ^a	7.0-31.0 (14.5) ^a	2.0-26.0 (8.0) ^b	3.0-17.0 (4.5) ^b
U-epinephrine : creatinine	7.0-914.0 (13.0)	2.0-25.0 (7.5)	1.0-47.0 (6.0)	1.0-18.0 (3.0)
U-normetanephrine : creatinine	467.0-12472.0 (2137.0) ^a	68.0-300.0 (147.0) ^b	34.0-208.0 (99.5) ^b	26.0-123.0 (56.0) ^b
U-metaneprine : creatinine	134.9-4976.0 (494.5) ^a	31.9-145.0 (56.5) ^b	28.9-145.0 (65.9) ^b	12.4-65.0 (31.5) ^b
P-norepinephrine (nmol/L)	1.1-108.0 (7.6) ^a	1.8-7.0 (2.3) ^b	0.6-5.1 (1.5) ^{b,c}	0.9-2.2 (1.6) ^b
P-epinephrine (nmol/L)	0.1-36.0 (0.7)	0.1-1.4 (0.6)	0.2-2.9 (0.8)	0.3-1.2 (0.7)
P-total normetanephrine (nmol/L)	6.5-673.0 (24.4) ^a	2.4-15.0 (6.3) ^b	2.2-7.2 (4.6) ^{b,c}	2.8-5.4 (3.1) ^b
P-free normetanephrine (nmol/L)	3.3-211.0 (11.8) ^a	1.5-6.6 (2.6) ^b	1.0-4.0 (2.4) ^b	0.9-2.1 (1.4) ^b
P-total metaneprine (nmol/L)	1.6-241.0 (6.4) ^a	0.3-4.2 (2.0) ^b	0.5-4.3 (1.6) ^b	0.4-2.2 (1.4) ^b
P-free metaneprine (nmol/L)	1.0-102.0 (3.8) ^a	0.4-1.7 (1.2) ^b	0.5-4.1 (1.1) ^b	0.3-1.2 (0.8) ^b

Different letters indicate statistically significant differences between the groups ($P < .05$).



40

Received: 15 July 2019 | Accepted: 14 February 2020
DOI: 10.1111/jvim.15743

STANDARD ARTICLE

Journal of Veterinary Internal Medicine
American College of Veterinary Internal Medicine

Safety of percutaneous ultrasound-guided fine-needle aspiration of adrenal lesions in dogs: Perception of the procedure by radiologists and presentation of 50 cases

Pascaline Pey¹ | Alessia Diana¹ | Federica Rossi² | Jeremy Mortier³ |
Ulrike Kafka⁴ | Stefanie Veraa⁵ | Anna Groth⁶ | Megan MacLellan⁷ |
Chiara Marin¹ | Federico Fracassi¹

TABLE 2 List of additional complications observed following percutaneous ultrasound-guided fine needle aspiration (FNA) of the adrenal lesions, reported directly by veterinary radiologists, which were not listed in the survey

Number of answers	Complication
7	Hemorrhage
2	Death
1	Shock
1	Hypotension
1	Adhesions at the FNA puncture site between the adrenal lesion and adjacent organs/tissue. This was observed during the adrenalectomy by the surgeon, and complicated the surgery

41

ORIGINAL RESEARCH

Veterinary Clinical Pathology ISSN 0275-4382

Accuracy of cytology in distinguishing adrenocortical tumors from pheochromocytoma in companion animals

Walter Bertazzolo¹, Martine Didier¹, Maria Elena Gelain², Silvia Rossi³, Luca Crippa⁴, Giancarlo Avallone⁵, Paola Boccabianchi⁶, Ugo Bonfanti⁷, Luca Giusti⁸, Federico Fracassi⁹

¹Veterinary Animal Hospital "Ces di Pace", Pavia, Italy; ²Department of Comparative Biomedicine and Nutrition, University of Padua, Padua, Italy; ³Veterinary Institute of Novara, Novara, Italy; ⁴Totipot, Sesto, Italy; ⁵Department of Veterinary Science and Public Health, University of Milan, Milan, Italy; ⁶Accademia, Nerviano, Italy; and ⁷Department of Veterinary Medical Science, University of Bologna, Bologna, Italy

Table 1. Cytologic key features of adrenocortical tumors and pheochromocytoma in dogs and cats (after ref. 9).

	Adrenocortical Tumors	Pheochromocytomas
General architecture	Many intact cells, singly or in cohesive clusters, with distinct cellular borders (Figure 1)	Many uniform naked nuclei, often on a finely granular and basophilic background, often in rows or rosette (Figure 2)
Intact cells	Perivascular pattern possible (Figure 3)	Rare intact round and plasmacytoid cells
Nuclear to cytoplasmic ratio	Common (Figure 5A, B)	Perivascular pattern possible (Figure 4)
Cytoplasm	Low (Figure 5A, B)	Rare (Figure 6)
	Basophilic and markedly vacuolated (small to medium lipid vacuoles) (Figure 5A, B)	High (Figure 6)
Nucleus	Round to oval, central to peripheral, with coarse/condensed chromatin (Figure 5A, B)	Pale blue, finely granular (Figure 6)
Nucleoli	Indistinct to prominent (Figure 5A, B)	Round to oval, with fine chromatin (Figure 6)
Other features	Hematopoietic precursors cells (extramedullary hematopoiesis) (Figure 7)	Indistinct (Figure 6)

42

Cytologic Evaluation as a Diagnostic Tool to Differentiate Adrenocortical Tumors and Pheochromocytomas

Hunter J. Piegols¹ | Rachel W. Williams² | Nirali Pathak² | Laura E. Seimic³ | Giovanni Tremolada³ | Russell Sakacs¹ | Laurie Millward¹ | Janis Lapsley⁴

¹The Ohio State University Veterinary Medical Center, The Ohio State University, Columbus, Ohio, USA | ²UF Small Animal Hospital, University of Florida, Gainesville, Florida, USA | ³Platt Animal Cancer Center, Colorado State University, Fort Collins, Colorado, USA

Correspondence: Hunter J. Piegols (piegols.3@osu.edu)

Received: 26 July 2024 | Revised: 21 January 2025 | Accepted: 29 January 2025

Funding: The authors received no specific funding for this work.

Keywords: adenoma | adrenal | aspirate | carcinoma | cytology

ABSTRACT

Background: The utility of cytologic evaluation to distinguish adrenocortical tumors and pheochromocytomas in dogs has not been thoroughly investigated, partly because of the perceived risks of the procedure.

Objectives: Report test characteristics of fine needle aspiration (FNA) and cytologic evaluation for differentiation of adrenocortical tumors and pheochromocytomas in dogs. Complications associated with FNA also were recorded.

Animals: Thirty-eight dogs with 40 adrenal tumors that had FNA and cytologic evaluation performed before adrenalectomy were included in the study from three institutions. Tumors included 17 pheochromocytomas, 21 adrenocortical tumors, 1 concurrent adrenocortical adenoma and pheochromocytoma, and 1 malignant neoplasm.

Results: Of the 40 FNA cytologic aspirations performed, 35 (87.5%) had a predominant cell type identified and therefore were considered of diagnostic quality. Of these, 30 (85.7%) correlated with the final histopathological diagnosis. When all samples were included, FNA and cytologic evaluation had a sensitivity of 77.3%, specificity of 76.5%, positive predictive value of 81.0%, negative predictive value of 72.2%, and accuracy of 76.9% for identifying adrenocortical tumors. For pheochromocytomas, these values were 72.2%, 95.2%, 92.8%, 80.0%, and 84.5%, respectively. Six (15.9%) dogs had self-limiting complications associated with the FNA procedure.

Conclusion and Clinical Importance: Fine needle aspiration and cytologic evaluation of adrenal tumors has a low complication rate and can help differentiate adrenocortical tumors and pheochromocytomas. Thus, cytologic evaluation of adrenal tumors should be considered to help differentiate adrenal tumors and allow more individualized treatment of affected dogs.

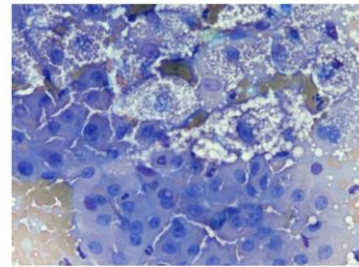


FIGURE 1 | Cytology of canine adrenocortical adenoma. Fine needle aspirate of an adrenal mass was markedly cellular and contained numerous variably sized clusters of relatively uniform large oval to polygonal epithelial cells. The nuclear to cytoplasmic ratio was low. Cells exhibited mild to rarely moderate anisocytosis and anisokaryosis. The cells contained round nuclei with occasional one to two prominent nucleoli and finely to coarsely stippled chromatin. The cytoplasm is abundant and pale pink to amphophilic in color. Occasional cells contained numerous distinct small cytoplasmic vacuoles. (Wright-Giemsa, 500x objective).

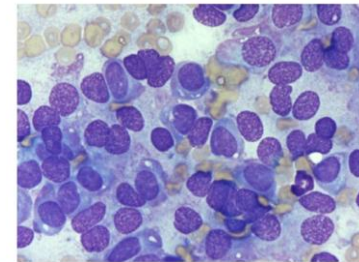


FIGURE 2 | Cytology of canine pheochromocytoma. Fine needle aspirate of an adrenal mass was markedly cellular with numerous naked nuclei and rare to occasional intact cells consistent with endocrine/neuroendocrine origin. Cells were arranged individually and in small clusters. Intact cells displayed mild anisocytosis and anisokaryosis. The nuclear to cytoplasmic ratio was high. Cells were oval to polygonal with a small amount of medium blue cytoplasm that occasionally contained moderate numbers of fine pink granules. The nuclei were oval and centrally placed with coarsely stippled chromatin and inconspicuous nucleoli. (Wright-Giemsa, 100x objective).

43

TRATAMENTO

- ◆ Preparo para Adrenalectomia
- ◆ Controle HAS com **α-bloqueadores**
 - **Fenoxibenzamina (0,25 – 2 mg/kg bid a tid) → 6x > chance sobreviver a adrenalectomia / indisponível no Brasil**
 - **Prazosina (Minipress) 1 mg / 15kg, BID**
 - **Doxazosina (1mg/animal, SID a BID)**
- ◆ Aumento gradual dose até controlar HAS, redução dose se hipotensão
- ◆ Controle taquicardia com **β-bloqueadores** → Atenolol (0,2 – 1 mg/kg sid a bid)
 - ◆ Jamais usar sozinho, pode piorar HAS, devido a vasoconstricção **α1** sem oposição



44

Controle HAS durante Adrenalectomia

- ◊ **Fentolamina** → controle PAS com **α -bloqueador curta ação**
 - ◊ Bolus 0,02 a 0,1 mg/kg seguida seguida CRI..
- ◊ **Esmolol** → controle taquicardia com **β -bloqueador curta ação**
 - ◊ Bolus 50 – 500 mcg/kg seguida CRI 50-200 mcg/kg/ min
- ◊ **Lidocaína** → controle arritmias ventriculares
 - ◊ Bolus /2 mg/kg seguido CRI 20 – 80 mcg/kg/min
- ◊ **HIPOTENSÃO** → Reduzir dose fentolamina, Prova de carga com cristaloides, Dobutamina (> contratilidade), vasoativos (fenilefrina, norepi, vasopressina..)

45

Received: 11 September 2018 | Revised: 11 March 2019 | Accepted: 9 April 2019
 DOI: 10.1111/vsu.13221

Veterinary Surgery. 2019;48:742–750.

ORIGINAL ARTICLE – CLINICAL

WILEY

Perioperative morbidity and mortality in dogs with invasive adrenal neoplasms treated by adrenalectomy and cavotomy

Philipp D. Mayhew BVM&S, DACVS¹ | Sarah E. Boston DVM, DACVS² |

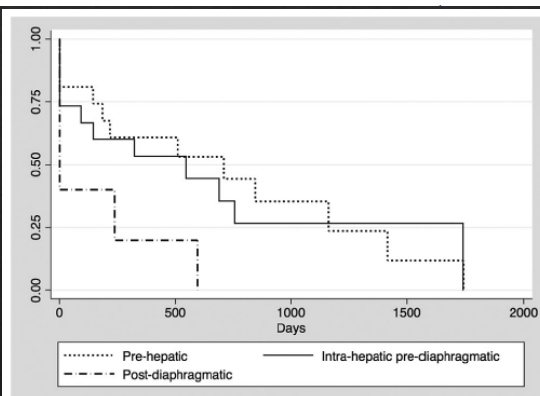


FIGURE 1 Kaplan-Meier overall survival estimates in 45 dogs by caval location of thrombus termination

- ◊ 45 casos, sendo que 36 eram feocromocitomas

46

RESEARCH ARTICLE

Open Access



Retrospective evaluation of toceranib phosphate (Palladia®) use in the treatment of inoperable, metastatic, or recurrent canine pheochromocytomas: 5 dogs (2014–2017)

Margaret L. Musser^{1,2*}, Kathryn L. Talkowski^{1,3}, Chad M. Johannes² and Philip J. Bergman⁴

Abstract

Background: Effective treatment options for inoperable, metastatic, or recurrent canine pheochromocytomas are lacking. In humans, specific germline mutations exist that drive the development of pheochromocytomas. Pharmaceutical blockade of these abnormalities with small molecule inhibitors are an effective treatment strategy. Similar mutations may exist in the dog, and thus, treatment with similar small molecule inhibitors may provide a survival advantage. The purpose of this study was to assess the role of toceranib phosphate in the treatment of inoperable, metastatic, or recurrent canine pheochromocytomas.

Results: Retrospectively, medical records of dogs that had a diagnosis or suspect diagnosis of a pheochromocytoma were reviewed for information regarding response to toceranib phosphate and overall outcome. Five dogs were identified that fit the inclusion criteria. All five experienced clinical benefit (1 partial response, 4 stable disease). Progression-free interval (PFI) for the dog with the partial response was 61 weeks. PFI for the two dogs with stable measurable disease was 36 weeks and 28 weeks. PFI in the two dogs with stable metastatic disease were at least 11 weeks and 18 weeks.

Conclusions: Based on this limited series of dogs, the results suggest that toceranib may have biological activity in dogs with primary and metastatic pheochromocytomas. Larger studies are needed to define the use and response to toceranib in dogs with gross, microscopic, and metastatic pheochromocytoma.

Keywords: Pheochromocytoma, Toceranib, Canine, Metastasis, Recurrent

❖ Toceranib 2,75 mg/kg
❖ Dias alternados

ORIGINAL ARTICLE

Toceranib phosphate for the treatment of dogs with high-risk adrenal gland tumours: 16 cases (2019–2023)

C. Chalfon^{1*}, L. Marconato¹, S. Galac¹, A. M. Tardo¹, M. Zandvliet¹, E. Fracassi¹, F. Del Baldo¹, G. Ghisoni¹, L. Pisoni¹ and R. Finotello¹

OBJECTIVES: The aims of this study were to evaluate the response rate, time to progression (TTP) and survival times of dogs with high-risk adrenal gland tumours (ATs) treated with toceranib phosphate, in both macroscopic and microscopic setting, and to report the adverse event (AE) profiles.

MATERIALS AND METHODS: Medical records of dogs diagnosed with a high-risk adrenocortical carcinoma (ACC) or pheochromocytoma (PCC), treated with toceranib, were retrospectively reviewed. High-risk ATs were defined as inoperable and/or metastatic ATs or cortical tumours with high Utrecht score. Endpoints were response rate, TTP and overall progression-free survival time (PFST). Adverse events were reported according to VCOG-CTCAE.

RESULTS: Sixteen dogs were included: 10 diagnosed with PCC and six with ACC. All dogs with ACC received adjuvant toceranib due to a high Utrecht score or metastatic disease, while all dogs with PCC were treated with toceranib in the macroscopic setting. A clinical benefit was detected in 80% of dogs with PCC: four achieved stable disease for a median TTP of 176.5 days, and two achieved partial response for 182 and >100 days, respectively. Median PFST for dogs with PCC was 112 days. Among dogs with ACC, 3 (50%) progressed and were euthanized after 237, 364 and 273 days; the remaining 3 (50%) dogs were alive and disease free 382, 508 and 583 days after starting toceranib. Overall, toceranib was well-tolerated.

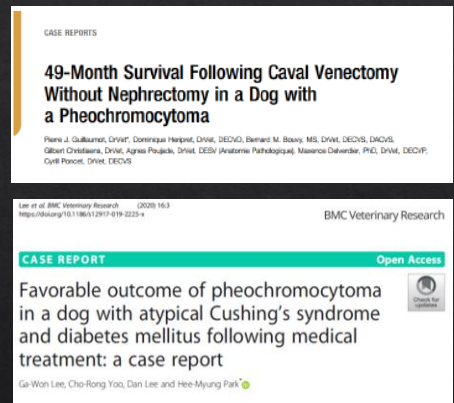
CLINICAL SIGNIFICANCE: Toceranib may offer clinical benefit and improve outcome in dogs with high-risk ATs in both the macroscopic and microscopic disease setting.

Journal of Small Animal Practice (2025); 1–8
DOI: 10.1111/jsap.13840

❖ Toceranib por via oral
❖ Dose mediana inicial de 2,4 mg/kg (intervalo de 2 a 2,9), arredondada para o tamanho de comprimido disponível mais próximo
❖ Segundas, quartas e sextas-feiras.

Prognóstico

- ◆ Mortalidade perioperatória relatada 10-20%
- ◆ Fatores de risco para sobrevida a curto prazo
 - Tamanho do tumor, hemorragia adrenal aguda
 - Invasão vascular extensa
- ◆ Sobrevida longo prazo até > 4 anos



49

Received: 7 April 2019 | Revised: 19 August 2019 | Accepted: 24 August 2019
DOI: 10.1111/vec.13069

CASE REPORT



Autoresuscitation and pheochromocytoma multisystem crisis in a dog

Michael T. Kato DVM¹ | John M. Mallard DVM²

¹ Department of Clinical Sciences, North Carolina State University, Raleigh, North Carolina, USA

² Emergency and Critical Care, VCA West Coast Specialty and Emergency Animal Hospital, Fountain Valley, California, USA

Correspondence
Michael T. Kato, Department of Clinical Sciences, North Carolina State University, 3322 Swinford Ct, Raleigh, NC 27604, USA.
Email: mtkato2@ncsu.edu

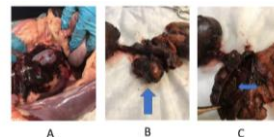


FIGURE 1 (A) Hemorrhage showing apparent hemorrhage in the left retroperitoneal space. (B) Labiodorsal view of the adrenal mass. (C) Cross-section of the adrenal mass showing internal hemorrhage

Abstract

Objective: To describe the clinical course of a dog with a pheochromocytoma multisystem crisis that exhibited autoresuscitation after cardiac arrest.

Case Summary: An approximately 10-year-old male neutered terrier mix dog presented for collapse. Abdominal imaging was suggestive of a pheochromocytoma, and clinical pathology data and thoracic imaging suggested the presence of a multisystem crisis. The dog developed cardiopulmonary arrest that was followed by autoresuscitation.

New or Unique Information Provided: To the authors' knowledge, this is the first report of autoresuscitation in a dog. The phenomenon may have been associated with a pheochromocytoma multisystem crisis.

KEYWORDS

canine, Lazarus phenomenon, return of spontaneous circulation

50

INCIDENTALOMAS adrenais

Conceito de incidentaloma: *massa (>1cm) descoberta ao acaso em investigação radiográfica (Rx, US, TC, RM) sem presença de sinais clínicos que sugiram doença adrenal*

51



Clinical findings in dogs with incidental adrenal gland lesions determined by ultrasonography: 151 cases (2007–2010)

Audrey K. Cook, BVMS&S; Kathy A. Spaulding, DVM; John E. Edwards, DVM, PhD

JAVMA 2014;24:1181-5

- 4% of dogs had an Incidentaloma
- Predominantly older dogs (median age: 11 yrs)
- 30% had a malignant adrenal tumor; size = 20-46 mm
- 28.5% had non-adrenal malignant tumors:
lymphoma, metastasis

Galac, 2018

6

52

Prevalence of adrenal gland masses as incidental findings during abdominal computed tomography in dogs: 270 cases (2013–2014)

JAVMA • Vol 249 • No. 10 • November 15, 2016

Jared I. Baum BA

Sarah E. Boston DVM, DVSC

J. Brad Case DVM, MS

From the Department of Small Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL 32608. Mr. Baum's present address is PO Box 100125 HSC, Gainesville, FL 32610.

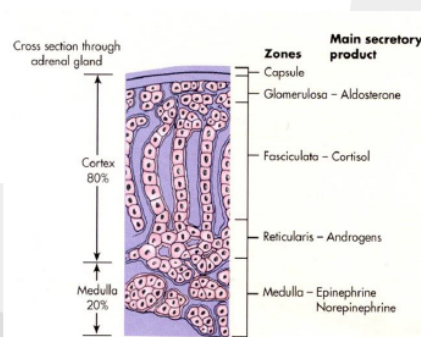
- 9.3% of dogs had an adrenal mass
- Elderly dogs: median 12 yr
- Histopathology (only in 3 dogs):
1 cortical adenoma and 2 pheochromocytomas

Galac, 2018

7

53

Adrenal mass: what can it be?



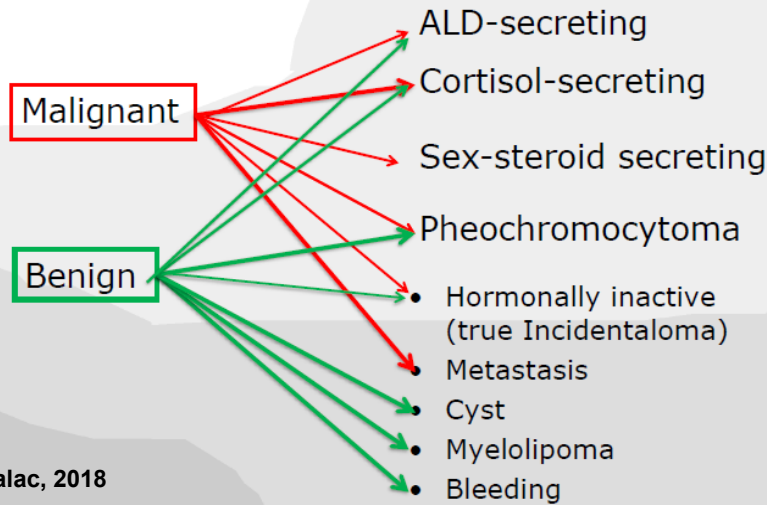
ALD-secreting
Cortisol-secreting
Sex-steroid secreting
Pheochromocytoma

- Hormonally inactive (true Incidentaloma)
- Metastasis
- Cyst
- Myelolipoma
- Bleeding

Galac, 2018

54

Adrenal mass: what can it be?



Galac, 2018

55

Glucocorticoid and mineralocorticoid production in hormonally silent adrenocortical tumor tissue in dogs

Kirsten L. van Bokhorst^{1,2}, Marit F. van den Berg³, Hans S. Kooistra¹, Monique E. van Wolferen¹, Elpetra P. M. Timmermans-Sprang¹, Andrea Corsini³, Stefania Golinelli⁴, Nicole Bechmann⁵, Mirko Peitzsch⁵, Sara Galac^{1,*}

¹Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, 3584 CM Utrecht, The Netherlands
²IVC Evidensia, 2992 LC Barendrecht, The Netherlands
³Department of Veterinary Science, University of Parma, 43100 Parma PR, Italy
⁴Department of Veterinary Medical Sciences, University of Bologna, 40064 Ozzano dell'Emilia BO, Italy
⁵Institute for Clinical Chemistry and Laboratory Medicine, University Hospital and Faculty of Medicine Carl Gustav Carus, Technische Universität Dresden, 01307 Dresden, Germany
*Corresponding author: Sara Galac, Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, Yalelaan 108, 3584 CM, Utrecht, The Netherlands (S.Galac@uu.nl).

Abstract

Background: No consensus exists regarding the monitoring and therapeutic approach to adrenal tumors (ATs) discovered incidentally by diagnostic imaging, when standard endocrine testing yields negative results.

Hypothesis/Objectives: To evaluate tissue concentrations of adrenocortical steroids in hormonally silent adrenocortical tumors (SATs) in dogs.

Animals: Fourteen dogs with SATs (12 unilateral, 2 bilateral), 11 dogs with cortisol-secreting adrenocortical tumors (cs-ACTs) and 10 healthy dogs.

Methods: Observational study. Diagnosis of SAT was based on finding an AT on diagnostic imaging, negative endocrine function tests, and histopathological and immunohistochemical confirmation. Adrenocortical steroid tissue concentrations were measured by liquid chromatography with tandem mass spectrometry and compared between SATs, cs-ACTs, and normal adrenals (NAs).

Results: Hormonally silent adrenocortical tumors exhibited higher median tissue cortisol (3.62 ng/mg, range 0.05–18.1) and 21-deoxycortisol (0.08 ng/mg, range 0.00–0.44) concentrations than NAs (cortisol 0.38 ng/mg, range 0.01–1.90; 21-deoxycortisol 0.01 ng/mg, range 0.00–0.03; $P = .04$ and $P = .001$, respectively), and these concentrations were not significantly different between SATs and cs-ACTs. Furthermore, SATs' median tissue concentrations of mineralocorticoid precursors corticosterone (2.15 ng/mg, range 0.01–14.1) and 18-OH-corticosterone (0.70 ng/mg, range 0.00–4.89) were higher than in NAs (respectively 0.19 ng/mg [range 0.14–0.54] and 0.05 ng/mg [range 0.01–0.33]; both $P = .01$) and not different when compared to cs-ACTs.

Conclusions and clinical importance: This study on tissue metabolomics in ATs in dogs demonstrates comparable tissue concentrations of specific glucocorticoids and mineralocorticoids in SATs and cs-ACTs. This implies that some SATs are not hormonally silent, prompting further studies on diagnostics, treatment, and monitoring recommendations.

56

“Incidentalomas” podem não “silentes”

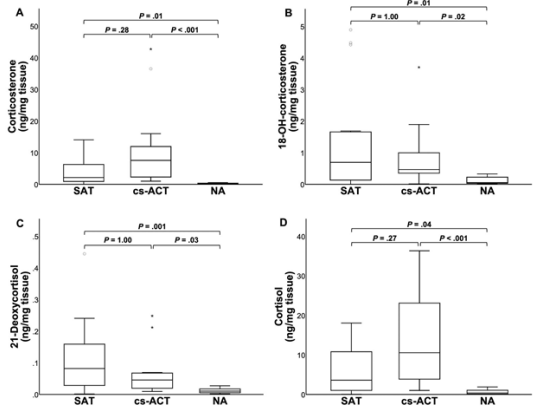


Figure 2 Boxplots of corticosterone (A), 18-OH-corticosterone (B), 21-deoxycortisol (C), and cortisol (D) tissue concentration for SATs, cs-ACTs, and NAs. Boxes represent the interquartile range and lines within the box represent the median. Whiskers represent the range, extending to a maximum of 1.5 times the interquartile range. Circles represent outliers that fall above the third quartile + 1.5 times the interquartile range, while asterisks represent extreme outliers exceeding the third quartile + 3 times the interquartile range. Abbreviations: SAT = silent adrenocortical tumor; cs-ACT = cortisol-secreting adrenocortical tumor; NA = normal adrenal.


[Speaker List](#)
[Go to Table of Contents: Main · SAIM · Endocrinology](#)

Adrenal Incidentaloma: Clinical and Histopathological Characteristics (Abstract EN19)

ACVIM 2019

Viviani De Marco¹; Rodrigo Ubukata²; Isabella Sant'Anna³; Marcia Kahvegian⁴; Sara Galac⁵

 Naya Endocrinologia Veterinária; ²DABROVET - PROVET; ³Santo Amaro University; ⁴PROVET, Universidade Cruzeiro do Sul; ⁵Faculty of Veterinary Medicine, Utrecht University, the Netherlands

Adrenal incidentaloma (AI) is defined as an incidentally discovered adrenal mass in a dog not suspected of having an adrenal disease. In this retrospective study we report on clinical and histopathological data in 22 dogs with an AI, detected by abdominal ultrasonography. Most dogs had no clinical complaints, except obesity in two dogs. Abdominal ultrasonography was performed as a part of wellness screening or for non-medical reasons. Characteristics on ultrasonography suggestive of an AI were abnormal adrenal shape, heterogeneous structure, increased adrenal thickness (>10 mm) and/or expansion into blood vessels. There were 15 females (14 neutered) and 7 males (7 castrated). Their mean ± SEM age was 11±2 years. The most prevalent breed was Lhasa Apso (7), followed by Shih Tzu, Maltês and Dachshund (2). The median body weight was 7 kg (range, 4 to 32 kg). Urinalysis revealed good concentrating ability of kidneys with median specific gravity of 1.040 (range, 1.015 to 1.050) and no glucosuria. Complete blood count was unremarkable, except slightly increased alkaline phosphatase, cholesterol and triglycerides in few dogs. The low-dose dexamethasone screening test was negative in all dogs. Median basal cortisol concentration was 1.8 µg/dl (range, 0.8 to 2.7 µg/dl) and at 8-hours 0.4 µg/dl (range, 0.15 to 0.9 µg/dl). There were 19 unilateral and 3 bilateral AIs with the greatest diameter ranging from 1.1 to 5.6 cm. In dogs with an unilateral AI, the contralateral adrenal gland was of normal structure and shape and the adrenal thickness was not increased. All dogs underwent unilateral adrenalectomy. In three dogs with bilateral AIs, only the largest adrenal mass has been removed. Histopathology disclosed adrenocortical adenoma in seven dogs (two bilateral), adrenocortical carcinoma in ten dogs (one bilateral), and a malignant pheochromocytoma in five dogs. This is the first report on clinical features and histopathology of AI in a large group of dogs. Female dogs of small breeds and elderly age were the most commonly affected. The majority of AIs were of adrenocortical origin, however, pheochromocytoma should be accounted as a differential diagnosis as well.

- ◆ 22 cães com incidentalomas (15 fêmeas – 14 castradas, 7 machos castrados)
- ◆ Lhasa, Shi Tzu, Maltês e Dachshund super-representados
- ◆ Diâmetros de 1,1 a 5,6 cm (19 casos unilaterais e 3 bilaterais)
- ◆ Adenoma em 7 casos
- ◆ Carcinoma em 10 casos
- ◆ Feocromocitoma em 5 casos

57

INCIDENTALOMAS adrenais

- ◆ Abordagem multissistêmica do paciente para excluir Cushing, Secreção Esteroides sexuais, Feo, Hiperaldo...



58

Demographics, Imaging Findings, Diagnosis, and Outcome for 74 Dogs Undergoing Adrenalectomy for an Incidental Mass

Audrey Cook¹; Phil Mayhew²; Federico Massari³; Felipe Lillo⁴; Ameet Singh⁵; Bart Van Goethem⁶; Sebastian Vam Nimwegen⁷

¹Professor, Small Animal Internal Medicine, College of Veterinary Medicine, Texas A&M University; ²University of California-Davis; ³Clinica Veterinaria Nervianese;

⁴Universidad Andrés Bello; ⁵Ontario Veterinary College; ⁶Ghent University; ⁷Utrecht University

BACKGROUND

Incidental adrenal masses (In-AMs) are routinely identified in dogs undergoing abdominal imaging. However, there is little information regarding likelihood of malignancy, and the risks vs. benefits of surgical intervention.

OBJECTIVES

- To compare findings in dogs with In-AMs against those with clinical adrenal masses (CI-AMs)
- To identify preoperative indicators of histologic diagnosis for dogs with In-AMs

ANIMALS

255 dogs undergoing laparoscopic adrenalectomy

METHODS

Demographics, lesion size, and histologic findings were compared for dogs with incidental vs. clinical masses. Survival to discharge was determined for dogs with In-AMs.

RESULTS

Masses were apparently incidental in 74/255 dogs (29.0%). Ages and body weights were similar to those with CI-AMs (126.6±25.7 vs. 122.0±27.3 months [p=0.234], and 15 (3.1–96) vs. 11 (3.0–65) kg [p=0.178], respectively). Malignancy rates were similar (56.7% vs. 62.2% [p=0.463]), although In-AMs were more likely to be pheochromocytomas (34.3% vs. 12.2%; OR 3.76 [1.933–7.42]; p=0.0002). Maximal mass dimension (MMD) was similar for both groups (2.5 [0.9–14] vs. 2.5 [1.3–6.7] cm; p=0.832). Twenty In-AMs had MMD ≤2 cm, 8 of which were noted to have vascular invasion on imaging. However, 6/11 small, noninvasive In-AMs were malignant (3 pheochromocytomas, 3 carcinomas). Three dogs died from surgical complications.

CONCLUSION

These findings suggest that the majority of In-AMs are malignant, and that size is not predictive of histopathologic findings. Short-term outcomes following elective laparoscopic adrenalectomy are generally good. Previous recommendations to simply monitor noninvasive In-AMs with MMD ≤2 cm should be reconsidered.

59



@Alan.Pöpl
 @Alan.Pöpl
 alan.poppl@ufrgs.com
 @endocrinohcv_ufrgs
www.ufrgs.br/petendocrine

Obrigado pela
Atenção!



60