FELINE PRIMARY HYPERALDOSTERONISM: AN UNDERDIAGNOSED ENDOCRINE DISEASE

Clinical presentation, diagnostic approach and therapeutic management

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INTRODUCTION

- Primary hyperaldosteronism (PHA) is caused by idiopathic bilateral nodular hyperplasia or adenoma/adenocarcinoma of the zona glomerulosa of the adrenal cortex.
- Affected cats present signs of arterial hypertension and/or hypokalemia, and chronic kidney disease (CKD) may be wrongly presumed to be the causal disorder instead of reach the definitive diagnosis by additional tests.

OBJECTIVES

- Analyze the most relevant clinicopathological aspects of PHA in cats and update the diagnostic techniques and therapeutic measures.
- Raise awareness about the high prevalence and the importance of consider PHA in any patient with signs of high blood pressure, hypokalemia and/or kidney disease.

BILATERAL HYPERPLASIA

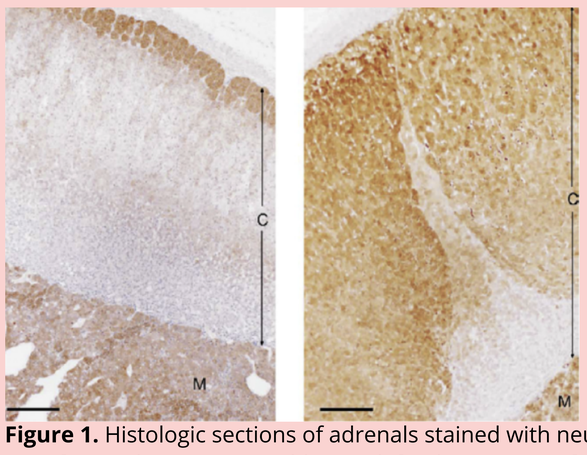


Figure 1. Histologic sections of adrenals stained with neuron-specific enrolase (NSE). Healthy cat (left), the staining of the cortex (C) is confined to the zona glomerulosa. Cat with PHA (right), cortex with multiple hyperplastic nodules, staining positive for NSA (Kooistra, 2020).

ETHIOPATHOGENESIS

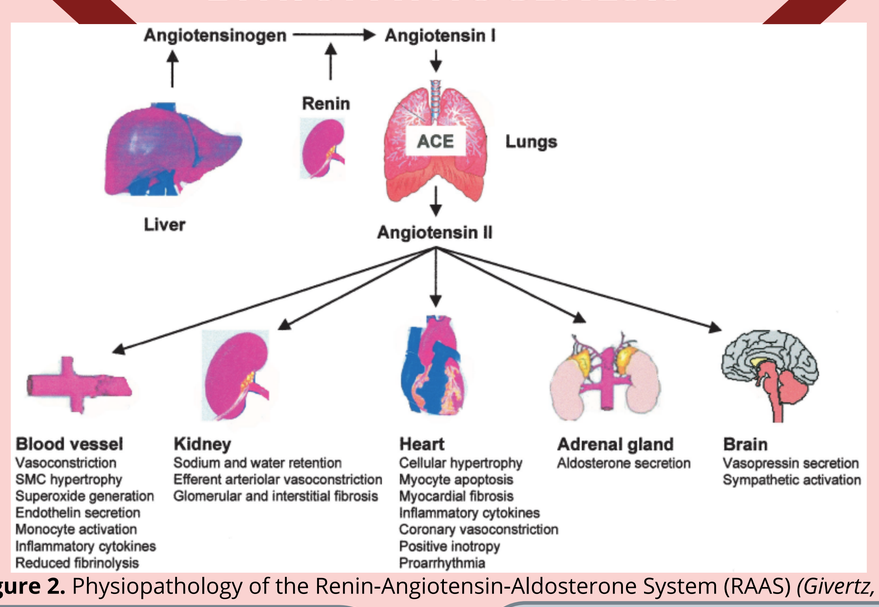


Figure 2. Physiopathology of the Renin-Angiotensin-Aldosterone System (RAAS) *(Givertz, 2001)*.

ADENOMA/ADENOCARCINOMA

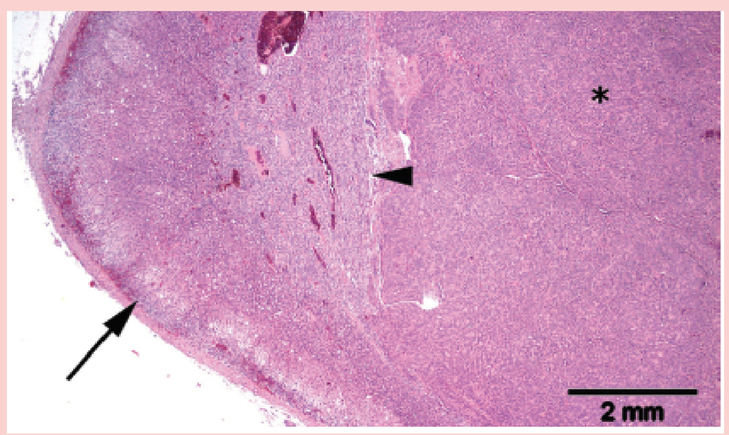


Figure 3. Histologic section of adrenal gland stained with haematoxilin-eosin. See the expanded neoplasm (*) in the adrenal cortex of a cat with PHA and the compression of the medulla (head of arrow) (Djajadiningrat-Laanen et al., 2011).

Figure 4. Funduscopic examination of a cat with retinal detachment secondary to arterial hypertension (Fernandez et al., 2016).

Uncomplete suppression of plasma renine activity
Mediator of **proggressive renal disease**
Less severe hypokalaemia
Predomination of **hypertension and CKD signs**

Complete suppression of plasma renine activity
More severe hypokalaemia
Predomination of **hypokalaemic signs**

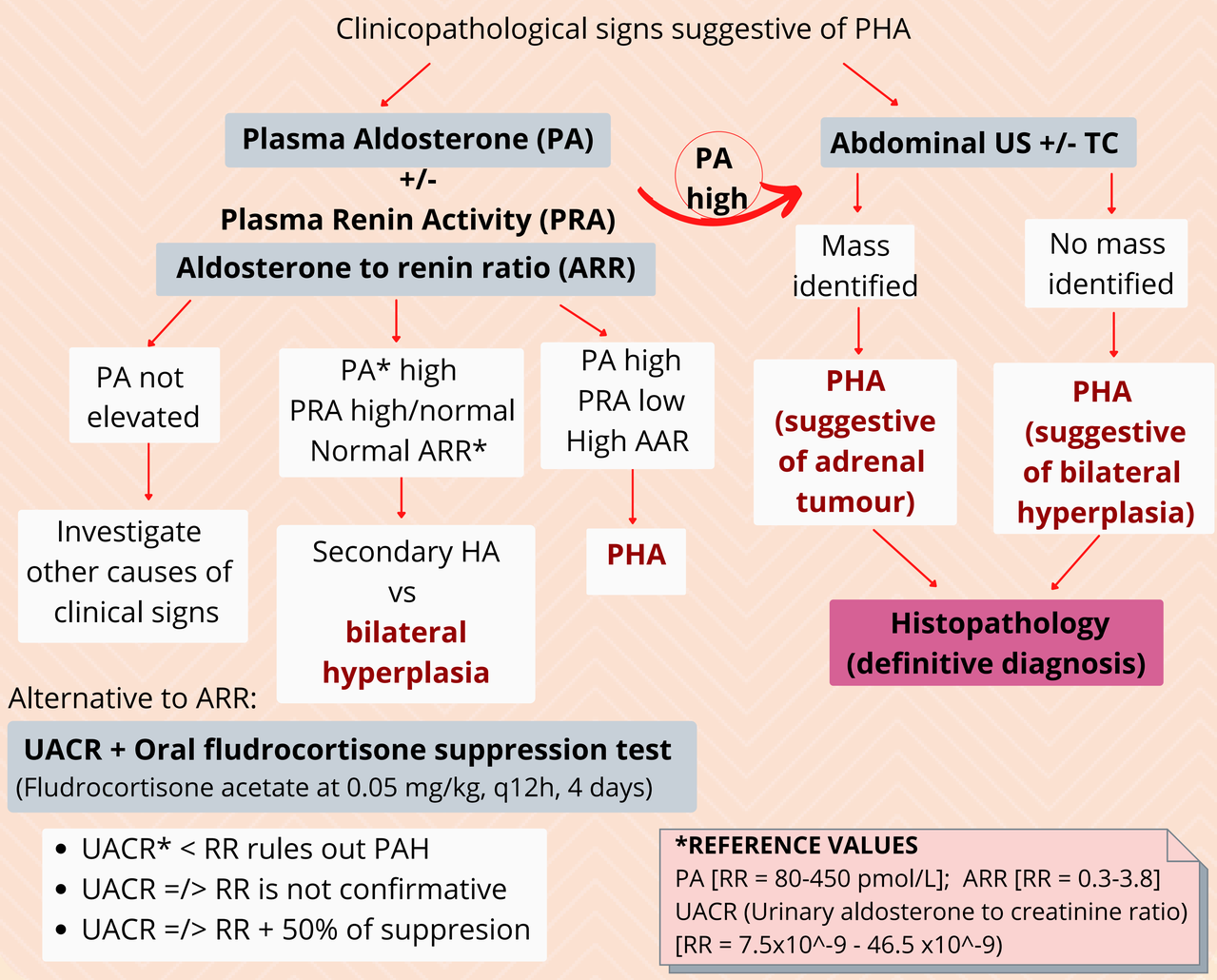
Figure 5. Cat with cervical ventroflexion (characteristic sign of PHA) (Kooistra, 2020).

CLINICOPATHOLOGICAL PRESENTATION

Signs of hypokalaemic polymyopathy	Weakness, cervical ventroflexion (K^+ <2.5 mEq / L), plantigradism, exercise intolerance, flaccid paresis with hyporeflexia, muscular hypotonia, respiratory failure, collapse. Others: arrhythmias, refractory to antiarrhythmic drugs
Signs of arterial hypertension	Ocular signs (SBP > 190 mmHg): hyphema, mydriasis, optic nerve edema and/or atrophy; degeneration, hemorrhage and/or retinal edema, retinal detachment, sudden blindness - Hypertensive encephalopathy: changes in mental status, ataxia, cranial nerve deficits, seizures - Left ventricular hypertrophy
Unspecific signs	PU/PD, polyphagia, DM, urinary incontinence, pendulous abdomen, skin fragility syndrome and alopecia (hyperprogesteronism), lethargy, anorexia, weight loss, diarrhea, restlessness/wheezing GPE: Palpable masses, irregular kidneys, arrhythmias, murmurs, marked muscle atrophy
Laboratory findings	Hypokalemia (50%), normokalemia [RR = 4-5.5 mEq/L K^+] Increased CK (> 50%> 1000 IU/L) [RR = <120IU/L] Increased BUN and creatinine, proteinuria (50%) Hypomagnesemia, normo/hypophosphatemia, hypocalcemia. Rare hypernatremia +/- Hyperglycemia

Table 6. Summary of different clinical presentations and laboratory findings of feline PAH. *(SBP = systemic blood pressure; PU/PD = polyuria/polydipsia; DM = diabetes mellitus; GPE: general physical examination; CK: creatine kinase; BUN = blood urea nitrogen).*

DIAGNOSTIC APPROACH



TREATMENT & PROGNOSIS

Ethiopathogenia of PAH	Unilateral adenoma/ carcinoma	Bilateral hyperplasia
Treatment	Unilateral adrenalectomy (70% curative)	Chronic conservative therapy Spironolactone (2-4 mg/kg PO, q12h) + Potassium gluconate (2-6 mmol PO, q12h) +/- Amlodipine (0.1mg / kg, PO, q24h)
Prognosis	Excellent if survive the immediate postoperative period **Survival time**: 1-3 to 5 years	Poorer prognosis than complete adrenalectomy; better than non-resectionable tumor **Survival time**: months-years (not well documented)

Table 7. Therapeutical options and prognosis according to the etiopathogenesis of feline PAH. (*PO = orally administration*).

CONCLUSIONS

- PHA is the most common adrenocortical disorder in cats and should be considered in any cat with signs of hypokalemia, hypertension and/or signs of chronic kidney disease (Fernandez et al., 2016).
- If PHA is suspected, aldosterone concentration should be measured together with potassium levels in serum and imaging techniques must be performed (Bisignano y Bruyette, 2012).
- In cases of unilateral PHA adrenalectomy is recommended. However, fatal complications should be considered. Prognosis is excellent if survive the postoperative period (Djajadiningrat-Laanen et al., 2011).
- Medical therapy is indicated in cases of hyperplasia or non-resectionable tumor. Prognosis is not as favorable as complete adrenalectomy (Kooistra, 2020).