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<b>TITLE OF CASE</b> <i>Do not include "a case report"</i>
Hypoadrenocorticism in an aged cat
<b>SUMMARY</b> <i>Up to 150 words summarising the case presentation and outcome (this will be freely available online)</i>
A 13-year-old, female neutered, domestic long hair cat was referred with a 2 month history of fluctuating weakness, lethargy, inappetence and intermittently soft stools. Physical examination noted variable mentation, mild tachycardia with poor pulse quality and a body condition score of 1/9. In house haematology and biochemistry abnormalities included a mild neutrophilia, hyponatraemia and decreased Na:K ratio of 24 and isosthenuric urine (1.012). The cat was admitted to the hospital for intravenous fluid therapy and management of its electrolyte abnormalities. A low basal cortisol (36 nmol/L) was found on analysis of a stored serum sample and further investigations confirmed a diagnosis of hypoadrenocorticism. Treatment was implemented initially with hydrocortisone and dexamethasone and continued long term with desoxycorticosterone pivalate and oral prednisolone. More than one year since diagnosis, the cat is clinically well and stable on treatment.
<b>BACKGROUND</b> <i>Why you think this case is important – why did you write it up?</i>
Hypoadrenocorticism is a rare disease in the cat but should be considered in patients with compatible clinical signs and laboratory changes. Relatively few cases have been documented in the literature or in book chapters since the first case was reported in 1983 <sup>1-19</sup> .  Hypoadrenocorticism can be categorised into either primary or secondary disease. Primary hypoadrenocorticism results from destruction of the adrenal cortex and consequent inadequate production of glucocorticoids and mineralocorticoids <sup>2,9,10</sup> . Secondary hypoadrenocorticism results from decreased secretion of adrenocorticotrophic hormone (ACTH) secretion from the pituitary gland <sup>9,10</sup> .  The exact pathogenesis of feline primary hypoadrenocorticism is unknown <sup>2,14,15</sup> . In dogs, this disorder is usually due to autoimmune destruction of the adrenal cortex. This is thought to be the same for most cases of feline hypoadrenocorticism also <sup>14,15</sup> . In one case report of a cat with hypoadrenocorticism necropsy and histopathology of the adrenal gland showed lymphocytic infiltration of the cortex which supports an immune mediated cause in that

case<sup>1</sup>. Infiltration and destruction of the adrenal cortex from primary<sup>4</sup> and metastatic<sup>3</sup> lymphoma has been reported as a cause of hypoadrenocorticism in cats. Two cases of traumatically induced hypoadrenocorticism have also been documented<sup>5,6</sup>.

Secondary hypoadrenocorticism after iatrogenic suppression of ACTH secretion through administration of corticosteroids and progesterone hormones (such as megestrol acetate) have been described in cats<sup>7</sup>. Recently a case of feline hypoadrenocorticism secondary to lymphocytic panhypophysitis was recorded<sup>8</sup>. Other causes such as a congenital disorder or tumour of the pituitary gland have not been confirmed<sup>9,10</sup> although a congenital pituitary cause was suspected in a kitten with hypoadrenocorticism<sup>11</sup>.

Hypoadrenocorticism may be further classified as either typical and atypical. Typical hypoadrenocorticism is defined as a deficiency of both glucocorticoids and mineralocorticoids whereas the atypical form is deficient in glucocorticoids only. Both typical and atypical cases of hypoadrenocorticism have been described in cats<sup>12</sup>.

Cats of any age, breed or sex can develop primary hypoadrenocorticism<sup>2,9,10</sup>. There is no reported sex predilection and the median age at the time of diagnosis is 4 years (range 1.5-14)<sup>1-6, 9, 10, 12-19</sup>. The clinical history is often similar to that in dogs and includes lethargy, anorexia and weight loss and less commonly, vomiting, polyuria/polydipsia and waxing/waning illness<sup>1-6, 8-19</sup>. Diarrhoea and cardiac abnormalities have not been reported in cats with hypoadrenocorticism<sup>2,9,15</sup>. Clinical exam findings are often vague and non-specific, including depression, weakness, dehydration and hypothermia<sup>1-6, 8-19</sup>.

This case demonstrates the importance of having hypoadrenocorticism on the differential list and of obtaining a comprehensive minimum database and baseline samples prior to initiating symptomatic therapy. Overnight, this cat's Na:K ratio increased from 24 to 34 following intravenous fluid therapy with saline. Therefore, had the bloods been taken the following day, there may have been no indication to measure basal cortisol levels. This could have resulted in a missed or delayed diagnosis, which in this cat's case could have led to euthanasia. It also highlights that, as with canine hypoadrenocorticism, not all of the expected biochemical and clinical abnormalities associated with this condition have to be present to keep it as a differential diagnosis (i.e. this patient was relatively aged and presented with tachycardia, neutrophilia and normal potassium level). Therefore, basal cortisol concentration should be measured in compatible cases and further adrenal function testing performed if indicated.

#### **CASE PRESENTATION *Presenting features, clinical and environmental history***

A 13 year old, female neutered, domestic long haired cat was presented to the hospital's first opinion out of hours service as an emergency. She had a 2-month history of waxing and waning lethargy, weakness, reduced appetite and intermittently soft stools. The inappetence had progressed to complete anorexia over the 2 weeks prior and on the day of referral, she had become non-ambulatory. The owners reported no vomiting and were not aware of any possible intoxication or dietary indiscretion. She had no previous significant medical history and was primarily an outdoor cat. She was overdue vaccinations, worming and flea treatment. In-house blood tests at the referring vets had been unremarkable, although the electrolytes were not assessed.

On physical examination, the cat displayed variable mentation ranging from quiet but alert and responsive, to dull and listless when handled. She was non-ambulatory, weak and in extremely poor body condition (1/9) with pronounced muscle loss. The hair coat was poor and matted (Figures 1 and 2). Neurological examination was normal. She was mildly tachycardic at 200 bpm with poor peripheral pulse quality but thoracic auscultation was unremarkable and no heart murmur or arrhythmias were noted. Moderate gingivitis was present but otherwise oral examination was unremarkable and this was deemed to not be sufficient to cause the anorexia. Peripheral lymph node and abdominal palpation did not highlight any abnormalities. Her rectal temperature was normal (38.0°C) and she was underweight at 2.2kg.

#### **INVESTIGATIONS *If relevant***

Blood samples were taken for in-house haematology, biochemistry and electrolyte analysis. This revealed a neutrophilia (20.37x10<sup>9</sup>/l, RI 1.48-10.29 x10<sup>9</sup>/L), hyponatraemia (131 mmol/L, RI 150-165mmol/L) and hypochloraemia (95mmol/L, RI 112-129mmol/L). The potassium was normal but at the higher end of the reference range (5.4mmol/L, RI 3.5-

5.8mmol/L) giving a Na:K ratio of 24. The PCV was 34%. Free catch urinalysis documented isosthenuric urine (USG 1.012), borderline proteinuria (UPC 0.43, RI <0.2) and trace blood on a dipstick. Sediment examination documented many microorganisms but few white cells. FIV/FelV analysis was negative (IDEXX, SNAP FIV/FelV Combo Test). Serum samples were stored for basal cortisol and T4 measurement.

Over the next 24hrs, the cat clinically improved on symptomatic treatment with IV fluids and repeat electrolyte analysis was performed (Na<sup>+</sup> 142mmol/L, K<sup>+</sup> 4.2mmol/L, Na:K 34, Cl<sup>-</sup> 97mmol). The total thyroxine (T4) level was normal at 20.5 nmol/L (RI 15-50 nmol/L) but the basal cortisol level was at the low end of normal at 36 nmol/L (RI 14-138 nmol/L<sup>2</sup>) which prompted further adrenal testing.

An ACTH stimulation test demonstrated no response with a low post ACTH level of 41nmol/L (RI 124 – 359 nmol/L<sup>2</sup>) 60 minutes after ACTH injection. Aldosterone measurement documented a persistently low level both pre-ACTH <20 pmol/L (RI 87 – 224pmol/L) and post ACTH <20pmol/L (RI 149 – 451pmol/L). Endogenous ACTH concentration was high at 1469pg/ml (RI 38-176pg/ml). An abdominal ultrasound scan documented adrenal glands of a normal size (Left 2.6-3.4mm and Right 2.7-2.9mm) and no significant abnormalities. The culture from the free catch urine sample was positive for a B-haemolytic E.coli. A cystocentesis sample was collected but was negative for bacterial growth although the cat was receiving antibiotics by this time.

#### **DIFFERENTIAL DIAGNOSIS *If relevant***

The differential diagnosis of feline hypoadrenocorticism are numerous and include renal disease, gastrointestinal disease and other cardiovascular, neurological and muscular or metabolic causes of weakness. Although not present in this cat, if hypercalcaemia is present, other causes such as neoplasia or hyperparathyroidism could be considered.

Hypoglycaemia was not present in this case but has been reported in cats with primary hypoadrenocorticism with both neoplastic destruction of the adrenal cortex<sup>3</sup> and without<sup>17</sup>. Hypocortisolaemia reduces glucose precursor mobilisation from muscle and adipose tissue, reduces hepatic glycogen storage, reduces glycogenolysis and gluconeogenesis and increases peripheral glucose consumption<sup>17</sup>. Additionally these cats are usually anorexic, further compounding their risk of hypoglycaemia.

A decreased Na:K ratio is frequently found in cats with diseases other than hypoadrenocorticism, and is often associated with body cavity effusions<sup>20</sup> rather than hypoadrenocorticism.

This cat had a neutrophilia, which is unusual and may have been due to infection. She had evidence of a urinary tract infection and gingivitis which may have contributed to this.

Oral pain secondary to the gingivitis may have contributed to her inappetence along with the hypoadrenocorticism.

<p><b>TREATMENT <i>If relevant</i></b></p> <p>The cat was initially administered intravenous fluid therapy with 0.9% NaCl (Vetivex 1, Dechra Veterinary Products, UK) given at 4ml/kg/hr and intravenous cefuroxime at 20mg/kg q8hr (Zinacef, GlaxoSmithKline, UK).</p> <p>On receipt of the basal cortisol result, the patient was referred to the Internal Medicine department of the Small Animal Hospital and an ACTH stimulation test performed. Treatment with hydrocortisone (Solu-Cortef, Pfizer, UK) injections was instituted at 2mg/kg q6h for 24hrs. She was administered desoxycorticosterone pivalate (DOCP; Zycortal, Dechra Veterinary Products, UK) at 2.2mg/kg by subcutaneous injection and a single intravenous injection of dexamethasone (Dexadrenon, MSD Animal Health, UK) at 0.1 mg/kg.</p> <p>Forty-eight hours after presentation the cats mentation and electrolyte levels had returned to normal. She was noticeably stronger, brighter and eating well and the following day she was discharged with oral prednisolone (Prednicare, Animalcare, UK) at 1 mg/kg q24h and oral amoxicillin-clavulanate drops (Synulox, Zoetis, UK).</p>
<p><b>OUTCOME AND FOLLOW-UP</b></p> <p>At the 10 day recheck the cat was clinically well, had gained some weight (from 2.2 to 2.6kg) and had electrolyte concentrations within the normal reference range. At the 28 day recheck her electrolytes were again normal, she weighed 2.9kgs and she was given another injection of DOCP at 2.2 mg/kg subcutaneously. Over the following months, her DOCP injections were repeated every 28 days. The dose of DOCP was increased slightly to 2.4 mg/kg based on potassium levels consistently towards the upper end of the reference interval. She also underwent dental treatment at her referring veterinary practice during this time.</p> <p>More than one year since diagnosis, the cat remains well controlled on 2.4 mg/kg of DOCP q28d and 1 mg/kg prednisolone q24h. Her electrolytes are measured every 6 months and so far she has not required any dose alterations or further veterinary treatment.</p>
<p><b>DISCUSSION <i>Include a very brief review of similar published cases</i></b></p> <p>Hypoadrenocorticism is an extremely rare endocrinopathy in the cat<sup>1-19</sup>. From the case reports that have been published, cats seem to present with similar clinical signs and physical examination findings as dogs. Additionally the biochemical, electrolyte and haematological derangements are also comparable. Typical, atypical, iatrogenic, traumatic and neoplastic causes of primary hypoadrenocorticism have been reported in cats<sup>1-17</sup> and recently cases of secondary hypoadrenocorticism have been documented<sup>8,11</sup>.</p> <p>The ACTH stimulation test is the gold standard for diagnosis of hypoadrenocorticism in cats, as it is in dogs, although the protocol is different. For cats, 125 µg of synthetic ACTH is administered intramuscularly with samples taken just prior and 60 minutes afterwards<sup>15</sup>.</p> <p>Once treatment has been initiated, clinical signs often take a longer time to resolve in cats compared to dogs, often lasting 3 to 5 days<sup>2,9,10,15</sup>. Maintenance therapy involves mineralocorticoid support with or without added glucocorticoids. This has been successful with both oral fludrocortisone acetate and intramuscular or subcutaneous injections of DOCP and oral prednisolone<sup>12-19</sup>. The long-term prognosis for cats with hypoadrenocorticism is good but possibly not as good as for dogs<sup>2, 14-16</sup> and with adequate glucocorticoid and mineralocorticoid supplementation; these patients can have a normal life expectancy<sup>9,15</sup>.</p> <p>To the best of our knowledge, this is the first case report detailing the use of DOCP in a cat with hypoadrenocorticism in United Kingdom. Some of the medications mentioned in this case report are not licenced for use in cats and were used under the cascade.</p>
<p><b>LEARNING POINTS/TAKE HOME MESSAGES <i>3 to 5 bullet points – this is a required field</i></b></p> <ul style="list-style-type: none"> <li>• Cats can develop hypoadrenocorticism although it is a rare endocrinopathy</li> <li>• Hypoadrenocorticism should remain on the differential list and be investigated once other more common disorders have been excluded to explain compatible clinical signs</li> <li>• Electrolytes should be routinely measured as part of a minimum database</li> <li>• Samples should be stored for analysis at a later date if the patient is not responding as expected to treatment</li> </ul>

- Cats with hypoadrenocorticism often take longer to respond to therapy than dogs

**REFERENCES *Vancouver style***

1. Johnessee JS, Peterson ME, Gilbertson SR. Primary hypoadrenocorticism in a cat. *Journal of the American Veterinary Medical Association* 1983; 183:881–882.
2. Peterson ME, Greco DS, Orth DN. Primary Hypoadrenocorticism in Ten Cats. *Journal of Veterinary Internal Medicine* 1989; 3:55–58. doi:10.1111/j.1939-1676.1989.tb03080.x
3. Parnell NK, Powell LL, Hohenhaus AE, Patnaik AK, Peterson ME. Hypoadrenocorticism as the primary manifestation of lymphoma in two cats. *Journal of the American Veterinary Medicine Association* 1999; 214:1208–1211
4. Romine JF, Kozicki AR, Elie MS. Primary adrenal lymphoma causing hypoadosteronism in a cat. *Journal of Feline Medicine and Surgery Open Reports* 2016; 2:1-6 doi: 10.1177/2055116916684409.
5. Berger SL, Reed JR. Traumatically induced hypoadrenocorticism in a cat. *Journal of the American Animal Hospital Association* 1993; 29:337–339
6. Brain PH. Trauma-induced hypoadrenocorticism in a cat. *Australian Veterinary Practice* 1997; 27:178–181.
7. Middleton DJ, David A, Watson J, Howe CJ, Catterson ID. Suppression of cortisol responses to exogenous adrenocorticotrophic hormone and the occurrence of side effects attributable to glucocorticoid excess in cats during therapy with megestrol acetate and prednisolone. *Canadian Journal of Veterinary Research* 1987;51:60–65
8. Rudinsky AJ, Clark ES, Gilor C. Adrenal insufficiency secondary to lymphocytic panhypophysitis in a cat. *Australian Veterinary Journal* 2015; 93:327-331. doi: 10.1111/avj.12354
9. Myers NC, Bruyette DS. Feline adrenocortical diseases: part II - hypoadrenocorticism. *Seminars in Veterinary Medicine and Surgery (Small Animal)* 1994; 9:144–147.
10. Mooney C. Unusual endocrine disorders in the cat. *In Practice* 1998; 20:345-349. doi:10.1136/inpract.20.7.345
11. Giudice E, Macri F, Crino C, Vigano F, Di Pietro S. Hypoadrenocorticism in a young dwarf cat – case report. *Veterinarski Arhiv* 2016; 86: 591-600
12. Hock CE. Atypical hypoadrenocorticism in a Birman cat. *Canadian Veterinary Journal* 2011; 52:893–896.
13. Tasker, S., A. D. MacKay, and A. H. Sparkes. A case of feline primary hypoadrenocorticism. *Journal of feline medicine and surgery* 1999; 1: 257-260.
14. Stonehewer J, Tasker S. Hypoadrenocorticism in a cat. *Journal of Small Animal Practice* 2001; 42:186–190. doi:10.1111/j.1748-5827.2001.tb01800.x
15. Feldman EC, Nelson RW, Reusch CE, Scott-Moncrieff JCR, Behrend EN. Feline Hypoadrenocorticism. In: *Canine and Feline Endocrinology, Fourth Edition*. Elsevier Saunders, Missouri, pp. 514-516
16. Duesberg C, Peterson ME. Adrenal disorders in cats. *Veterinary Clinics of North America: Small Animal Practice* 1997; 27:321–347. doi:10.1016/S0195-5616(97)50035-0
17. Kasabalis D, Bodina E, Saridomichelakis MN. Severe hypoglycemia in a cat with primary hypoadrenocorticism. *Journal of Feline Medicine and Surgery* 2012; 14: 755–758. doi:10.1177/1098612X13480983
18. Woolcock AD, Ward C. Successful treatment of a cat with primary hypoadrenocorticism and severe hyponatremia with desoxycorticosterone pivalate (DOCP). *Canadian Veterinary Journal* 2015; 56:1158-1160.
19. Sicken J, Neiger R. Addisonian crisis and severe acidosis in a cat: a case of feline hypoadrenocorticism. *Journal of Feline Medicine and Surgery* 2013; 15:941-44. doi: 10.1177/1098612X13480983
20. Bell R, Mellor DJ, Ramsey I, Knottenbelt C. Decreased sodium:potassium ratios in cats: 49 cases. *Veterinary Clinical Pathology* 2005; 34:110-114. doi:10.1111/j.1939-165X.2005.tb00022.x

**FIGURE/VIDEO CAPTIONS *figures should NOT be embedded in this document***

Figure 1. The patient at initial presentation.

Figure 2. The patient’s poor hair coat and reduced body condition.

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