Decision making with adrenal tumors?
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Objectives:
1. Review the pathophysiology of adrenal masses.
2. Criteria for the incidental adrenal masses.
4. Understand surgical management of adrenal tumors with outcomes.

Pathophysiology: The adrenal gland has 2 functioning units the cortex and medulla, tumors of this gland can result in excessive function of these units. The cortex has three zones the glomerulosa, fasiculata, and reticularis which secrete mineralocorticoids, glucocorticoids and sex steroids, respectively. The medulla is responsible for production of catecholamines. Some adrenal tumors are not functional which make them less likely to cause clinical signs until their size leads to secondary problems. Non-functional adrenal tumors found incidentally are referred to as “incidentalomas”. About 40-50% of adrenal tumors arise from the cortex and ½ of these are malignant, of those about 10-50% will metastasize. Medullary tumors make up about 35% of adrenal tumors and these are usually malignant, although they have a lower metastatic rate of 20-30%. Adrenal tumors may be metastatic lymphoma, hemangiosarcoma or melanoma.

Hyperaldosteronism: Aldosterone is the primary mineralocorticoid and it functions to increase sodium and decrease potassium. This occurs with a functional tumor of the glomerulosa zone in the cortex of the adrenal gland. It leads to sodium retention, potassium excretion and hypertension. It is more common to see this tumor type in cats. It tends to affect older animals and they may present with lethargy, weakness, anorexia, ventroflexion of the neck, ataxia, collapse, polyuria and polydipsia, and blindness.

Cushings disease: Excessive secretion from an adrenal tumor occurs in about 15-20% of dogs with Cushings disease while the remaining 85% have pituitary dependent Cushing disease. Dogs are usually middle to old aged and Poodles, German shepherd dogs, dachshunds, Labradors, and terrier breeds tend to be overrepresented in retrospective studies. Common clinical signs are polyuria and polydipsia, alopecia, pendulous abdomen, hepatomegaly, polyphagia and weakness, but there are many other clinical signs that can be noted.
Hypersecretion of sex hormones: When the reticularis zone becomes hyperfunctional excessive androgens and or estrogens may be secreted resulting in development of secondary sex characteristics. Patients with atypical Cushings disease can have some clinical signs similar to hyperadrenocortisism, skin abnormalities and masculinization.

Pheochromocytoma: The medulla of the adrenal gland secretes epinephrine and norepinephrine in response to stress and metabolism. Functional tumors of the medulla lead to a waxing waning or episodic clinical presentation. These are usually older patients that may have weakness, collapse, panting, anxiety, seizures, blindness, and hypertension.

Incidentalomas: When an incidental adrenal mass is found a thorough history should be revisited to try and assess if the tumor is functional. Anytime an adrenal tumor is functional, surgery should be recommended. If there is no concern the mass is functional, then the mass should be evaluated and monitored for other criteria for surgery. Tumors that are > 2-3 cm or those that are doubling in size over 3-6 months should have surgery. Any adrenal mass that has vascular invasion should be surgically removed. Lastly, patients that have any waxing and waning clinical signs should have the mass removed.

Diagnostics: The work-up of dogs with suspected functional adrenal disease can be challenging and often debatable. A very good history and physical exam can be the first step in suspecting if an adrenal mass is functional or not. A complete blood count, chemistry profile and urinalysis can be helpful in establishing abnormalities suggesting which unit is hyperfunctional. Careful assessment of urine protein is important as patients with Cushings disease may have proteinuria which may increase the risk of hypercoagulation abnormalities. Many functional tumors of the adrenal gland can cause hypertension so all patients with adrenal tumors should have blood pressure checked. Functional testing is usually characterized as screening or differentiating. Screening tests include urine cortisol:creatinine ratio, ACTH stimulation test and LDDST while differentiating tests include LDDST, HDDST and endogenous ACTH. Imaging plays an especially important role when it comes to adrenal tumors. Abdominal ultrasound is often the first technique being used when investigating dogs that have clinical signs of functional adrenal disease. Ultrasound can be helpful in evaluating the size of both adrenal glands as well as looking for vascular invasion. Finding a contralateral adrenal gland that is smaller than normal, supports a functional tumor as the contralateral gland is suppressed. Computed tomography has become a superior imaging technique as it can more accurately evaluate vascular invasion, muscular invasion, and proximity to important vascular structures while obtaining a more accurate measurement of the mass. If a medullary tumor is suspected urine normetanephrine to creatinine ratio is the preferred test for diagnosis.
Pretreatment: Those patients with hypertension should be treated medically with ACE inhibitors or calcium channel blockers until the blood pressure is improved. If the patient is sick from hyperaldosteronism they should be managed to improve electrolyte abnormalities prior to surgery. Dogs with Cushings disease may also benefit from pretreatment with Trilostane although there is no evidence currently in the literature. Given the risks of thromboembolism, wound healing, and infection I personally treat Cushings patients for 4-6 weeks with Trilostane prior to surgery. Dogs with a pheochromocytoma have significantly decreased mortality rates when they have been pretreated with an alpha 1 and alpha 2 antagonist.

Surgery: Once the patient is ready for surgery, the approach is carefully determined based on the size of tumor, presence of vascular invasion, and concurrent abnormalities. As the adrenal gland is in the retroperitoneal space it can be challenging to approach. The right adrenal gland is covered by the vena cava, liver and kidney. Retraction of the duodenum and pancreas during surgery can increase the risk of pancreatitis. Tumors that are <4cm without vascular invasion are candidates for laparoscopic removal. Advantages to this technique include those associated with minimally invasive surgery and reduced manipulation of other structures in the abdomen. A flank and intercostal approach allows superior visualization dorsally, but there is limited access to the rest of the abdominal cavity. A ventral midline approach allows assessment of the abdominal cavity especially in cases that have vascular invasion. Specialized equipment, illumination, and good hemostasis are essential for success of these surgeries.

Outcome: The list of potential complications can sound intimidating and includes hemorrhage, thromboembolism, pancreatitis, renal failure/ nephrectomy, hypertension, tachycardia, arrhythmia, hypotension, Addisons, and death. That being said, patients who survival the perioperative time can have a good prognosis. Perioperative mortality rates range from 1-22% and can be associated with larger tumor size, cortical tumors, pancreatitis, renal failure and vascular invasion. Median survival times can be > 2-3 years which is why surgery is recommended. Many of these dogs die from other diseases if they don’t develop metastasis. The presence of vascular invasion doesn’t assume a worse prognosis, but may increase the risk of perioperative complications.