ADRENAL TUMORS AND THEIR REMOVAL:
The Left One is the Right One

Direct Veterinary Surgery
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Synopsis-- Anatomy and the Disease

The adrenal glands most commonly develop neoplasia from one of its two main cellular components—cortical cells (adenoma/adenoCA) and medullary cells (pheochromocytoma). Of the adrenocortical types, they can be functional (Cushing's Disease) or non-functional. Of the non-functional versions, the range in tumor behaviors is dramatic, from benign/incidental to aggressively invasive of major vascular structures and resultant caval syndrome. Those emanating from the medullary cells can take on a variety of functional behaviors depending on which of the medullary cell types have gone haywire—the most described being catecholamine-producing cells (think…epinephrine!) producing varied and bizarre clinical signs (of the cardiovascular, respiratory and central nerve systems) and anesthetic nightmares. Most adrenal tumors are unilateral, but have been reported bilaterally (with different tumor types in each!) Adrenocortical-secreting tumors usually make the opposite adrenal atrophy. Benign and malignant tumors are in equal prevalence; both cortical and medullary tumors can be both benign and malignant. Both dogs and cats can develop adrenal tumors.

Anatomically, the adrenal glands are typically small, often overlooked structures just cranial to the kidneys in the retroperitoneal space. On a routine exploratory, they are uniformly pale peach colored little "beans" that are visible and palpable. Any discoloration or raised area is a significant finding; tumors can be small and subtle. The right adrenal gland makes most surgeons sit up straight, when it enters the ultrasound report! Its very close proximity to the vena cava makes removal (when enlarged and invasive) significantly challenging (read—dangerous). Both left and right are in close enough proximity to the renal vasculature to make removal of large/invasive adrenal tumors a risk to renal integrity. A common tactic of the adrenocortical adenoCA is vascular invasion on the gross scale; large, finger-sized thrombi within the phrenicoabdominal-vena cava vessels is quite well documented.

Surgical Overview:

If small (1-2cm), and left-sided, removal of an adrenal mass is a "4" on a scale of 1-10 (with 1=OVH). If right-sided, the label increases to a "6". The approach is usually a routine ventral open laparotomy (or advanced laparoscopic) with abundant retraction, careful dissection and good hemostasis.

If large and left-sided and without vascular invasion, dissection is more involved and standard risks go up; right-sided large masses potentially become a critical risk if tumor wall abuts the vena cava.

For both left and right-sided tumors with gross vascular invasion/thrombosis, temporary vascular occlusion will be required. Risk is quite high for the surgical and post-operative periods; metastatic prognosis is poor.

Our best guide for operative planning is clear and unambiguous imaging, either ultrasound or CT/MRI. Unfortunately, an accurate preoperative distinction between benign and malignant or cortical vs. medullary is rarely possible.

The **indications & rationale** for surgical treatment are:

- Evidence of an adrenal mass that has demonstrated a change in size.
- Evidence of an adrenal mass with biochemical changes suggesting an associated functional hormonal abnormality.

Other options for treatment (besides surgery) are:

- Medical management of Cushing's disease or hypercatecholamine clinical signs.
- Medical management of caval syndrome clinical signs.
- Mitotane treatment to inhibit adrenal tumor growth

Supportive/ancillary options with surgical treatment are:

- Preoperative medical management of hyperadrenocortical clinical signs (ketoconazole).
- Preoperative medical management of hypercatecholamine clinical signs (alpha blocker/phenoxybenzamine)
- Electrolyte restoration
- Hyperglycemic control
- Thromoboembolic/DIC prophylaxis
- *Anesthetic regimen supporting CV system* (midazolam/hydromorphone, propofol, inhalant + narcotic IV PRN); avoiding ketamine, dexmedetomidine, atropine/glycopyrrolate, acepromazine.

The **perioperative experience** for pet and owner includes:

- Diagnostic testing (non/minimally invasive) sufficient to understand disease components (or less than recommended with associate risk discussion.)
- Preoperative and postoperative medications.
- High risk anesthesia/surgical episode.
- Postoperative ongoing hospital care (separate facility w/ owner transport).
- Moderately painful surgical experience, controlled with medication.
- Restricted postoperative activity and 2-3wk convalescence.
- Postoperative outpatient monitoring x 2-4wks.

Expectations for outcome are:

- Benign adrenal tumors successfully removed typically result in a cure.
- Malignant tumors successfully removed have a median survival of 680 days (1)
- Perioperative mortality of 22% (intraoperative mortality 4.8%). (1)
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Complications that may arise with this procedure are:

- Intraoperative bleeding—minor to catastrophic **Blood volume support options intraoperatively; blood transfusion options postoperatively.
- Intraoperative arrhythmia and hypertension—minor to catastrophic **Anesthetic planning.
- Perioperative thromboembolic event—minor to catastrophic **Aspirin pre-postop; heparin periop; plasma/heparin periop.
- Postoperative renal failure/anuria—transient or irreversible. **Monitor urine output x 1-3d; BUN/creatinine x 2-4wks
- Postoperative hypoadrenocorticism (Addison's disease)—transient **Steroid administration; adrenocortical axis function monitoring.
- Postoperative infection—perioperative antibiotics.

Postoperative **outcomes may be poor** due to the above complications, and/or:

- Metastatic tumor recurrence

What a surgeon needs prior to surgery:

- High quality ultrasound or CT/MRI imaging for surgical planning.
- Patient database sufficient to characterize CV system, adrenocortical axis, renal system.
- Preoperative alpha-blockade 2-3wks, if clinical signs support pheochromocytoma.
- Anesthetic and postoperative planning sufficient to address major potential complications.
- Skin near the surgery site CLEAR of infection (papules, pustules, crusts, collarettes, etc.) If urgent surgery, owner must be alerted to *increased risk* of incisional, deep and/or implant infections.
- Owner informed of risks and plan, with sufficient knowledge to understand consequences of less than full work-up and tertiary perioperative support.

General considerations and complications *for all surgery/anesthesia procedures are:*

- *Difficult and/or painful anesthetic recovery (variable; may require additional medications or re-hospitalization)*
- *Incisional infections (rare, minor; usually require oral antibiotics)*
- *Incisional dehiscence (rare, minor or major; may require surgical revision)*
- *Adverse anesthetic event (rare, major; may result in serious impairment or death)*

Proper owner expectations are important to a successful experience and patient outcomes. Please discuss this information with your clients while assisting them with decision-making for **Adrenal Tumor Removal**.

References:

1. Schwartz P, Kovak JR ,Koproswki A, et al: Evaluation of prognostic factors in the surgical treatment of adrenal gland tumors in dogs: 41 cases (1999-2005), J AM Vet Med Assoc 232:77, 2008.

Lara Rasmussen, DVM, MS
Diplomate, American College of Veterinary Surgery
DIRECT VETERINARY SURGERY, LLC

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