

Surgical diseases of the endocrine system

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Endocrine surgery is a newly developing specialty area integrating medical endocrinology, surgery and oncology. Patients with endocrine disease present with complaint due to excessive hormone production or mass effect caused by the endocrine tumor. The basic principle of endocrine surgery considers four important features. These are excessive hormone production, mass effect, abrupt imbalance of hormones caused by removal of the tumor and finally difficulty of surgical technique due to location and tendency for hemorrhage. Based on these special factors, an algorithm can be derived to help planning treatment for patients with endocrine disease. We must determine the functional activity of the mass, the extent of the mass, type and consequences of the hormonal deficit may occur upon its removal and likely complications during surgery. These steps could be summarized in an acronym as HIPS: **H**ormonal activity, **I**maging to determine extent of mass lesion, **P**reoperative treatment to avoid hormonal crisis, **S**urgical technique to minimize complications. The application of these principles is demonstrated below with frequently seen presentations of endocrine diseases.

Common manifestations of endocrine disease require surgical treatment include: Thyroid neoplasia, Primary hyperparathyroidism, Adrenal neoplasia, and Insulinoma.

Thyroid neoplasia:

Canines thyroid neoplasia represent about 1.2 -4.0 % of all canine tumors. Boxers, Beagles and Golden Retrievers are over represented. The majority of thyroid neoplasia is malignant. Functional activity is rare as only about 10 % of canine thyroid tumors cause hyperthyroidism. Ectopic thyroid tissue may be the source of thyroid tumor at unexpected locations (hyoid, thoracic inlet, mediastinum).

HIPS of thyroid neoplasia:

1. Hormonal activity - less than 10% has excessive thyroid hormone production. Iodine uptake may be more common. Anecdotally 70% of canine patients with thyroid masses have retained iodine uptake as it is seen with thyroid scintigraphy.
2. Thyroid scintigraphy can provide two important pieces of information. If thyroid mass has retained iodine uptake, the patient may be a candidate for postoperative radioactive iodine treatment as an alternative treatment. Secondly, the scintigraphy may allow detection of distant metastasis. All ventral cervical masses should have thyroid scan first

prior to imaging with computer tomography to avoid saturation of the thyroid with iodine contrast used for the CT scan. MRI or CT scan may prove helpful to assess the thyroid tumor for surgical resection.

3. Preoperative work-up: Coagulation panel and potentially blood crossmatch in preparation of the transfusion.
4. Surgical technique: Ligasure vessel sealing device for effective and quick hemostasis is helpful. Due to the close proximity of the trachea, only marginal resection can be achieved and therefore postoperative cancer treatment will be necessary.

Primary hyperparathyroidism: Primary hyperparathyroidism is a common cause of hypercalcemia in older dogs. Less commonly it can be seen in cats as well. Genetic basis to parathyroid adenomas has been established in the Keeshond breed. Most commonly only one of the four PT glands is involved, however, multiple glands are affected in about 7 % of the cases.

HIPS of primary hyperthyroidism:

1. Hormonal activity: excessive PTH resulting in hypercalcemia. Consider other differential diagnoses of hypercalcemia.
2. Imaging: cervical ultrasound may be helpful detected PT nodule and further supports diagnosis.
3. Pre- and postoperative management: Calcitriol treatment may be indicated for patients with severe pre-operative hypercalcemia.
4. Surgical technique: Preservation of normal parathyroid glands to avoid hypocalcemia

Adrenal Neoplasia: Patients with adrenal neoplasia present with clinical signs of corticosteroid and/or catecholamine excess. Tumors arising from the adrenal cortex commonly produce cortisol, less often aldosterone or progesterone. Tumors arising from the adrenal medulla produce catecholamines. Patients with cortisol producing tumors present with adrenal dependant Cushing's disease. 50% of the adrenocortical tumors are malignant and they occur unilaterally in 95% of the cases. Patients with tumors arising from the adrenal medulla (pheochromocytoma) may present with signs of catecholamine excess (collapse, weakness, PUPD, panting) or due to invasive mass causing venous obstruction (pelvic limb edema). Severe retroperitoneal hemorrhage has also been described secondary to pheochromocytoma.

HIPS of adrenal tumors:

1. Hormonal production: assays and imaging together are needed to determine hormonal excess.
2. Diagnostic Imaging: CT scan or MRI helps determining extent of the mass and assist in choosing best surgical approach (paracostal vs. midline)

3. Pre- and postoperative treatment: Medullary tumor - α -adrenergic block for 1-2 weeks prior to surgery to prevent hypertension and promote volume expansion; Cortical tumor – corticosteroid starting at surgery and continue as needed for 4-6 weeks.
4. Surgical technique: effective hemostasis is needed. Paracostal approach for non-invasive adrenal masses (especially right sided) may improve access. Invasive adrenal tumors are best approached via midline laparotomy.

Insulinoma: Autonomous neoplastic pancreatic islet cells produce hyperinsulinism. The disease is most commonly seen in older large-breed dogs. Irish Setter, Golden Retriever, German Shepherd Dog and Standard Poodle are predisposed. Presenting clinical signs are due to hypoglycemia (neuroglycopenic signs) and sympathetic discharge in an attempt to compensate for hypoglycemia (tremors, fasciculation, trembling). Less commonly, patients present with peripheral neuropathy affecting mainly the pelvic limbs. More than half of the patient with insulinoma, metastatic disease was found during laparotomy mainly in the liver and lymph nodes.

HIPS of insulinoma:

1. Hormonal activity: Hyperinsulinemia - insulin level measures higher than normal or inappropriately high with concurrent hypoglycemia.
2. Diagnostic Imaging: Dual phase computer topographic angiography has highest sensitivity for detecting Insulinoma.
3. Peri-operative treatment: dextrose solution to maintain blood glucose above 35 mg/dl.
4. Surgical technique: careful manipulation of the pancreas to minimize risk of postoperative pancreatitis. Jejunostomy tube placement helps managing postoperative pancreatitis if occurs.