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Perioperative complications of endocrine diseases

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Post-operative care represents an important aspect of critical care medicine. In multi-specialty practices, a team approach is often used to optimize the care of critical and post-operative patients. Endocrine surgery is routinely performed and may be accompanied by unique post-operative concerns. Especially as it relates to surgery involving the pancreas and the adrenal gland, anticipation of potentially life threatening complications is required for a successful outcome.

Surgery related to the pancreas

Surgical manipulation of the pancreas is generally approached with caution due to the potential of compromising the blood supply, and inducing post-operative pancreatitis. Pancreatic surgery is most commonly performed in dogs with pancreatic masses. Retrospective studies of dogs with insulinomas have shown a survival benefit to surgical resection over medical management, as well as confirmation of diagnosis, staging, and overall reduction of gross disease. Preoperatively glucose control can be challenging, with the major goal of stabilizing glucose concentration in a range that does not cause clinical signs of hypoglycemia. In severe cases, glucagon may be used to raise blood glucose and avoid clinical signs of hypoglycemia. Glucose supplementation may precipitate hypoglycemic crisis. Despite gentle manipulation, intra-operative manipulation of the pancreas may trigger insulin release and worsening hypoglycemia. For this reason, blood glucose should be monitored frequently throughout surgery and at regular intervals post-operatively. Dextrose is administered in those patients with worsening hypoglycemia and maintained during the post operative period until the dog is eating. Techniques used to raise blood glucose in those dogs showing clinical signs of hypoglycemia that are refractory to glucose supplementation include the following:

- Glucagon infusion (5-40ng/kg/min)
- Glucocorticoids (dexamethasone 0.3mg/kg IV)
- Diazoxide (6.6-40mg/kg/day divided)

It is important to note that seizures due to hypoglycemia may continue after correction of hypoglycemia and anticonvulsants can be added. In severe cases where seizures cannot be controlled, general anesthesia may be required.

Although hypoglycemia from incomplete tumor removal is the most frequently reported post-operative concern, hyperglycemia is also a common post operative finding. Due to chronically elevated circulating insulin concentration, function of normal beta cells may be suppressed leading to hyperglycemia following tumor resection. This transient diabetic state resolves once function of the normal beta cells is restored, typically lasting 2-3 days. In very few cases where hyperglycemia is severe and persistent, insulin therapy may be initiated. In these cases, urine glucose monitoring should be performed frequently to avoid a hypoglycemic crisis.

Despite gentle manipulation of the pancreas, post-operative pancreatitis remains a common complication of partial pancreatectomy and may require intensive care. Cardiovascular support in the form of intravenous fluids is encouraged in the post operative period, as is feeding of frequent small meals consisting of a low fat, low carbohydrate high fiber diet to prevent spikes of insulin release. Fasting dogs with pancreatitis is no longer recommended and enteral feeding should be begin post-operatively as soon as the dog is alert enough to eat. Since most insulinomas are not completely excised, prolonged fasting is typically avoided and small frequent feedings are encouraged to maintain euglycemia.

Surgery related to the adrenal gland

In our facility, the surgical approach to adrenal masses is commonly preceded by a discussion between specialists in anesthesia, surgery, and critical care in order to establish a plan for anesthesia, blood product availability, and intraoperative as well as post operative management of any complications. Adrenal masses may be secretory or non-secretory, and can be due to adenoma, carcinoma, or pheochromocytoma. Whether or
not to pursue surgery can be difficult to determine, due to the high incidence of intra operative and post-operative complications. Tumor invasion into surrounding structures and tumor size are highly suggestive of malignancy. Post-operative complications of adrenocortical tumors are generally related to long term excessive circulating cortisol and include immunosuppression, impaired wound healing, hypertension, hypercoagulability and pancreatitis. Medical control of hyperadrenocorticism and hypertension may reduce the likelihood of postoperative complications. In dogs with adrenocortical adenomas or adenocarcinomas, atrophy of the contralateral adrenal gland and limited adrenocortical reserve should be expected and corticosteroids may be required for a period of time after surgery.

Pheochromocytoma – Surgical removal of these catecholamine producing tumors of the adrenal medulla may be accompanied by cardiovascular collapse due to massive catecholamine release during surgical resection. Complications associated with pheochromocytomas include the following:

- Tachycardia
- Arrhythmias
- Hypertension
- Hypotension
- Hemorrhage
- Thrombosis, thromboembolism
- Cardiac arrest

ECG monitoring is typically initiated during the preoperative period and continued post-operatively due to the high risk of ventricular arrhythmias. Pre operative control of tachycardia using beta blockers (propranolol, atenolol) may be helpful. Pre-operative administration of an alpha adrenergic receptor blocker such as phenoxybenzamine (0.5mg/kg q12 hours) has been shown to reduce post operative mortality in dogs with pheochromocytoma. All drugs that are pro-arrhythmogenic or that potentiate the effects of catecholamines are generally avoided. Cardiovascular support and blood pressure monitoring is performed throughout the induction and surgical period due to the concern for both arrhythmias and hypertension during induction, and acute reduction in vascular tone following tumor removal.

During surgery, hemorrhage is a significant concern due to proximity of the adrenal gland to great vessels and the extensive blood supply to the tumor itself. Availability of blood products should be confirmed prior to induction. Hypercoagulability secondary to excessive cortisol secretion and systemic inflammation associated with surgery puts these dogs at risk for thrombotic complications in the peri-operative period, and perioperative anticoagulation is controversial. In dogs suspected of post operative pulmonary thromboembolism, anticoagulation can be initiated (unfractionated or low molecular weight heparin) and supportive care with oxygen supplementation should be initiated.

Finally, special consideration must be given to endocrine disease as a co-morbidity in any dog or cat undergoing surgery. Animals with diabetes mellitus or chronic renal failure are susceptible to rapid development of hypovolemia and special consideration must be given to their perioperative intravenous fluid therapy. A carefully considered plan for fasting and insulin therapy is required prior to surgery in the diabetic. Glucose monitoring perioperatively will help with decisions relative to feeding and insulin therapy during this post-operative period. In those animals experiencing volume related issues post operatively, the reason is most often attributed to inadequate rate of IV fluid administration and failure to supply a bowl of water. The maintenance needs of these animals is altered, and frequent re-assessment of volume status with adjustments of fluid rates is needed to tailor fluid therapy to each patient.