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Recent Updates in peri-operative management of Endocrinal Crisis during general anesthesia

An Essay

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Mariam Nady Foad

List of Contents

List of Abbreviations

Abb.		Full Term
5-HIAA	:	Hydroxyindoleacetic acid
ABG	:	Arterial Blood Gases
ACTH	:	Adrenocorticotrophin
AVP	:	Arginine Vasopressin
CAD	:	Coronary Artery Disease
CgA	:	Chromogranin A
COPD	:	Chronic Obstructive Pulmonary Disease
CPAP	:	Continuous Positive Airway Pressure
CRH	:	Corticotropin-Releasing Hormone
CSF	:	Cerebrospinal Fluid
CT	:	Computed Tomography
CVP	:	Central Venous Pressure
DHEA	:	Dihydro epiandro strone
DI	:	Diabetes Insipidus
DK	:	Diabetic Ketoacidosis
EtCO	:	End tidal Carbon Dioxide
FSH	:	Follicle-Stimulating Hormone
GH	:	Growth Hormone
GV	:	Glycemic Variability
HPA	:	Hypothalamus-Pituitary-Adrenal
HR	:	Heart Rate
IAH	:	Impaired Awareness of Hypoglycemia
IV	:	Intravenous
LH	:	Luteinizing Hormone
LMA	:	Laryngeal Mask Airway
MAP	:	Mean Arterial Pressure
MIBG	:	Metaiodobenzylguanidine
MRI	:	Magnetic Resonance Imaging
NIBP	:	Non-Invasive Blood Pressure
NSE	:	Neuronal Specific Enolase
PA	:	Pituitary Apoplexy
PAT	:	Paroxystic Atrial Tachycardia
PC	:	Pheochromocytoma Crisis

List of Abbreviations

Abb.		Full Term
PCA	:	Patient-Controlled Analgesia
PNMT	:	Phenylethanolamine N-Methyltransferase
PO	:	Oral
POC)	:	Point of Care
POMC	:	Proopiomelanocortin
PONV	:	Post-Operative Pain, Nausea and Vomiting
PRL	:	Prolactin
PTU	:	Pro-Pylthiouracil
PVCs	:	Premature Ventricular Contractions
RFA	:	Radiofrequency Ablation
RLN	:	Right Laryngeal Nerve
SIADH	:	Syndrome of Inappropriate Secretion of Antidiuretic Hormone
SSKI	:	Saturated Solution of Potassium Iodide
T_3	:	Tri-iodothyronine
T_4	:	Tetra-iodothyronine
TIVA	:	Total Intravenous Anesthesia
TS	:	Thyroid Storm
TSH	:	Thyroid-Stimulating Hormone
TSH	:	Thyroid Stimulating Hormone
VAE	:	Venous Air Embolism

List of Tables

Figure No.	Title	Page No.

List of Table

Tables No. **Title** **Page No.**

Abstract

Endocrine emergencies pose unique challenges for the attending anesthetic specialist while managing endocrinal crisis. Besides taking care of primary disease state, one has to divert an equal attention to the possible associated endocrinopathies also. One of the common reasons for inability to timely diagnose an endocrinal failure in patients being the dominance of other severe systemic diseases and their clinical presentation. The timely diagnosis and administration of therapeutic interventions for these endocrine disorders can improve the outcome. The timely diagnosis and administration of timely therapeutics in common endocrine disorders like severe thyroid storm, acute adrenal insufficiency, pheochromocytoma, DKA and carcinoid crisis significantly influence the outcome and prognosis. Careful evaluation of clinical history and a high degree of suspicion are the corner stone to diagnose such problems. Aggressive management of the patient is equally important as the complications are devastating and can prove highly fatal.

Endocrinal emergencies pose numerous unique challenges during surgical, anesthetic and intensive care management. The advancements in neuro-endocrine surgical interventions, both diagnostic and therapeutic, have been well supported by similar advancements in anesthesiology and intensive care. The advent of new anesthetic drugs, adjuvants, cardiac agents, cerebro-protective agents, etc. has made the preoperative, peri-operative and postoperative management of these surgical procedures relatively easy.

Safe and quality anesthesia practices mandate a thorough pre-operative assessment and preparation of the patient for surgery. Surgery on endocrinal crisis are quite unique as it involves the principles and practices of both endocrine and anesthesiology management. The challenges to the anesthesiologist become manifold as the surgical approach differs in different patients

A multidisciplinary approach involving the endocrine surgeon, , anesthesiologist, endocrinologist and intensivist is mandatory during the preoperative, peri-operative and postoperative period for a successful surgical outcome.

We tried to review some of the common endocrine emergencies in intensive care unit and the challenges associated with their diagnosis and management and to review and discuss some of the most important recent and advanced clinical aspects regarding the anesthesia and intensive care implications in endocrinal crisis.

Keywords: DkA: diabetic ketoacidosis.

Introduction &Rationale

With ever increasing number of pre and peri-operative patients presenting for surgery with co-morbid endocrine disorders, the challenges for the anesthesiologists have grown manifold. Apart from caring for the impact of surgical pathology on endocrine functions, anesthesiologist also confronts endocrine disorders and manages their possible implications during anesthesia procedures (**Niezgoda and Morgan, 2013).**

Endocrine complications are more likely to occur in routine daily anesthesia practice in patients presenting with endocrinopathy, but may occur in all. It is therefore mandatory that an anesthesiologist should be thoroughly well-versed with all endocrine pathologies and complications, which can be encountered during surgical practice so as to "suspect," "prevent," "diagnose," and "manage" them in a timely and appropriate manner **(Bajwa and Jindal, 2012).**

The choice of anesthesia is determined by pathophysiological alterations due to different endocrinopathies related to pancreas, thyroid, parathyroid, adrenal, pituitary, and others (**Bajwa and Kalra, 2014).**

The modern day anesthesiologist has to look after intensive care services as well. Occurrence of co-morbid endocrinopathies does impact the management and prognosis of critically ill patients. Timely detection and management of endocrinopathies in such patients can be life-saving (**Kalra et al., 2013; Bajwa and Kulshrestha, 2012; Bajwa and Kwatra, 2012).**

Still, many new endocrinopathies and metabolic disorders develop *de novo* during the course of treatment either due to infections and drug effects/interaction or can arise as a complication of various therapeutic procedures such as *de novo* endocrinopathy: Acute hypoparathyroidism after thyroid surgery; hypopituitarism after pituitary surgery; long term Nelson's syndrome after adrenal surgery; diabetes after transplant new onset diabetes after transplantation (NODAT) and many more (**Bajwa and Bajwa, 2011).**

Autonomic function and integrity is of utmost importance while formulating the plan of anesthesia. As autonomic dysfunction is commonly encountered in many of the endocrine disorders such as diabetes, adrenal disease, and other, pre-operative assessment and intra-operative vigilance is important (**Kalra et al., 2013).**

Equally, crucial is the assessment of cardiovascular status, neuro-muscular functions, renal parameters and

various other organ systems, which are directly or indirectly affected by various endocrinopathies (**Bajwa and Kalra, 2014).**

Pituitary apoplexy is defined as acute hemorrhagic infarction of a gland whose blood supply is earlier compromised by a tumor or pregnancy. It may be due to obstetric hemorrhage, sickle cell crisis and head injury. Usually, there is acute failure of anterior lobe function. The posterior lobe function generally remains normal. Common features are severe headache, nausea and vomiting, visual field defects and cranial nerve palsies. It is managed by treating adrenocortical failure with intravenous fluids, urgent transsphenoidal decompression and replacement of hydrocortisone (**Nawar et al., 2008)**.

Patients with Addison's disease are at risk of developing a potentially fatal crisis in the perioperative period after cardiac surgery. The clinical presentation in this setting can masquerade as other complications associated with cardiac surgery such as severe inflammatory response during surgery or post-cardiotomy shock syndrome in the early postoperative period; hence patients with Addison's disease should be closely monitored and the management strategy adapted to allow early identification of crises and

consequently a successful management (**D'Silva et al., 2012)**.

Anesthetic management of pheochromocytoma consists of several points: perioperative hemodynamic control, intraoperative control, and postoperative care. Generally perioperative hemodynamic control can be performed by anesthesiologist and endocrinologist. The mainstay therapy consists of combination of an α-adrenergic blocker and β-blocking agent. Short-acting, selective, competitive α1-adrenergic receptors blockers (doxazosin 2 - 6 mg daily) have been used in pheochromocytoma's patients to prepare them for surgery. Intraoperatively several points are to be considered. Standard and invasive monitoring is mandatory (**Domi, et al., 2015).**

Anesthetic considerations, for a patient undergoing pituitary surgery, are always a challenge to the anesthesiologist. The management requires the knowledge of neurosurgical aspects of anesthesia in general and pituitary disease in particular. The pathophysiology involving the hormonal alterations due to pituitary disease may have significant effect on the outcome of the surgery. The perioperative anesthetic considerations also depend on the technique of surgery (**Malhotra et al., 2013)**.

The commonest cause for thyroid storm is either a severe illness or a poor preoperative preparation for thyroid surgery. The classical features of thyroid storm such as abdominal pain, diarrhea, nervousness and restlessness cannot be elicited and only hyperthermia and cardiac arrhythmias can be seen under general anesthesia. Treatment consists of emergency management of tachycardia with β-blockers, cooling of the body by decreasing the ambient room temperature, infusion of cold fluids and draping in ice-cold packs, and administration of steroids. Propylthiouracil and methimazole are used in fairly high doses to decrease the thyroid hormone synthesis (**Ondik et al., 2010)**.

Myxoedema crisis is a critical emergency situation which can be encountered in patients with profound hypothyroidism. It manifests clinically as a constellation of signs and symptoms which include, but are not limited to, severe lethargy, hypothermia, bradycardia and hypoxemia due to alveolar hypoventilation. The condition, if untreated, can deteriorate and progress to congestive heart failure and pericardial effusion. Emergency interventions sometimes do require intravenous administration of T3 and T4, but such interventions can precipitate congestive cardiac failure and myocardial ischemia (**Debapriya and Paul, 2004).**

Many patients who have deranged thyroid physiology, namely hyperthyroidism and hypothyroidism, have to undergo various elective and emergency surgical procedures at some stage of their life. The attending anesthesiologist has to face numerous daunting tasks while administering anesthesia to such patients. The challenging scenarios can be encountered at any stage, be it preoperative, intra-op or postoperative period. Preoperatively, deranged thyroid physiology warrants optimal preparation, while anticipated difficult airway due to enlarged thyroid gland further adds to the anesthetic challenges. Cardiac complications are equally challenging as also the presence of various co-morbidities which make the task of anesthesiologist extremely difficult (**Bajwa and Sehgal, 2013).**

The effects of surgical stress and anesthesia have unique effects on blood glucose levels, which should be taken into consideration to maintain optimum glycemic control. Each stage of surgery presents unique challenges in keeping glucose levels within target range (**Sudhakaran and Surani, 2015)**. Diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar states (HHS) are the main acute metabolic complications of diabetes (**Sobngwi et al., 2009).**

Carcinoid tumors are uncommon, slow-growing neoplasms. These tumors are capable of secreting numerous

bioactive substances, which results in significant potential challenges in the management of patients afflicted with carcinoid syndrome (**Mancuso et al., 2011)**.

Anesthetic management for massive blood loss with hemodynamic instability secondary to carcinoid crisis can be challenging in the perioperative setting. Hypotension, diarrhea, facial flushing, bronchospasm, and tricuspid and pulmonic valvular diseases are the common manifestations of carcinoid syndrome (**Mancuso et al., 2011)**.

The present study aims at an in-depth analysis of potential risk factors and challenges during administration of anesthesia and possible complications in patients with endocrinal emergencies.