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Thyroid Storm

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Introduction

Thyroid Storm is an extreme hyperthyroidism that is an endocrine emergency with a mortality rate of 20-30% (Janezic, 2013). The condition is a rare diagnosis that occurs in 0.2 persons/100,000 population/year according to a recent manuscript (Bacuzzi, Guzzetti, De Martino, Severgnini & Cuffari, 2017). Thyroid storm is more common in persons 30-40 years of age and are female more than male (Schreiber, 2017). In the United States, the incidence of thyroid storm is more frequently seen in Caucasians and Hispanics than in African Americans (Schreiber, 2017). While the disease occurs mainly in those with pre-existing hyperthyroidism, it can also occur in those without it (Schreiber, 2017).

Topic Importance

As a future Nurse Anesthetist (CRNA), knowledge of this emergency endocrine topic will be vital for application throughout all specialties of patients. Thyroid Storm can occur intraoperatively and as a postoperative complication that can lead to mortality. Knowledge of the disease process, signs and symptoms and early treatment are necessary to prevent the associated mortalities with this disease.

Risk Factors:

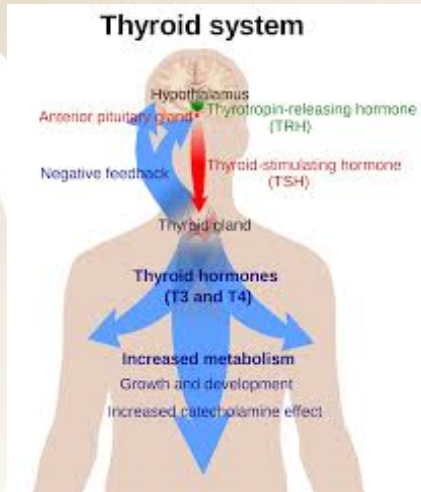
- Older age
- Cardiovascular complications
- Cerebrovascular disease
- Pulmonary disease
- Renal Failure
- Infection
- Trauma
- Poorly controlled diabetes
- Existing Grave's disease or Toxic multinodular goiter

Pathophysiologic Process

Underlying Process

Normal thyroid hormone physiology is maintained by feedback mechanisms between the hypothalamus, anterior pituitary and thyroid gland. In Thyroid Storm, the physiology of the disruption in function is not well understood. The disorder has been closely tied to a known diagnosis of Graves disease and toxic multinodular goiters, although it can occur without those diagnosis (Ross, Burch, Cooper, Greenlee, Laurberg, Maia & Walter, 2016). Graves disease is an autoimmune disease wherein autoantibodies affect TSH stimulation, resulting in excessive production of T3 and T4 (Ross, Burch, Cooper, Greenlee, Laurberg, Maia & Walter, 2016). Likewise, in Thyroid Storm, there is an increased response to thyroid hormone and an increased or abrupt availability of free hormones and enhanced binding to thyroid hormone receptors. Similar to Graves Disease, there is an increase in T4 and T3, but not any higher of levels as in uncomplicated thyrotoxicosis (Chiha, Samarasinghe & Kabaker, 2015). There has been found to have higher levels of mean dialyzable fraction of T4 and mean free T4 levels, despite similar levels of total T4 (Chiha, Samarasinghe & Kabaker, 2015). This could be because of a reduction in carrier protein affinity for T4 (Chiha, Samarasinghe & Kabaker, 2015). A decrease, then, in hormone-binding capacity with various stressors and may increase the concentrations of free, bioactive moieties (Chiha, Samarasinghe & Kabaker, 2015).

The rapid increase in free hormone levels may also be a contributor to the body's physiologic response during Thyroid Storm. There is also an adrenergic aspect that contributes to Thyroid Storm. There is an enhanced responsiveness to endogenous catecholamine related to an increase in tissue specific beta-adrenergic receptor density or modification in post receptor signaling pathways (Chiha, Samarasinghe & Kabaker, 2015). T3 has been shown to amplify the transcriptional response to norepinephrine in brown adipose tissue, which is where thermogenesis occurs (Chiha, Samarasinghe & Kabaker, 2015). The level of cyclic adenosine monophosphate are increased and therefore increases the binding of beta adrenergic receptors, which is why propranolol is an effective treatment in Thyroid Storm (Chiha, Samarasinghe & Kabaker, 2015).



Thyroid Storm (Thyroid Crisis). (2017, June 6). Physiopedia. Retrieved 18:25, July 24, 2018 from [https://www.physio-pedia.com/index.php?title=Thyroid_Storm_\(Thyroid_Crisis\)&oldid=173481](https://www.physio-pedia.com/index.php?title=Thyroid_Storm_(Thyroid_Crisis)&oldid=173481).

Pathophysiologic Process continued

Significance

Thyroid hormones influence every tissue and organ system. When increased, there is an increase in thermogenesis and basal metabolic rate, decreased serum cholesterol levels and decreased SVR occurs. If left untreated, Thyroid Storm can lead to weight loss, osteoporosis, atrial fibrillation, embolic events, muscle weakness, tremor, neuropsychiatric symptoms, cardiovascular collapse and death related to high output heart failure (Ross, Burch, Cooper, Greenlee, Laurberg, Maia & Walter, 2016).

Triggering conditions could be drugs such as amiodorone, serafenib, ipilimumab, inappropriate hormone ingestion, radioactive therapy and exposure to excess iodine (Bacuzzi, Guzzetti, De Martino, Severgnini & Cuffari, 2017).

Burch & Wartofsky Score

grading scale of thyroid storm severity

<25 - unlikely to represent storm 25-44 - suggests impending storm >45 - highly suggestive of storm

| Temp | CNS | GI/Liver | HR | Heart Failure | Precipitant |
|------------------|------------------|-----------------|----------------|-------------------|-----------------|
| 99-99.9 5 pts | Agitation 10 pts | N/V/D 10 pts | 99-109 5 pts | Pedal Edema 5 pts | Negative 0 pts |
| 100-100.9 10 pts | Delirium 20 pts | Jaundice 20 pts | 110-119 10 pts | Rales 10 pts | Positive 10 pts |
| 101-101.9 15 pts | Seizure 30 pts | /Coma | 120-129 15 pts | Atrial Fib 15 pts | |
| 102-102.9 20 pts | | | 130-139 20 pts | | |
| 103-103.9 25 pts | | | >140 25 pts | | |
| >104.0 30 pts | | | | | |

Kim, E. (2017). Thyroid storm. Retrieved from <http://blog.clinicalmonster.com/2017/06/thyroid-storm/>

Signs and Symptoms

- Extreme anxiety
- Fever
- Tachycardia
- Cardiovascular instability including arrhythmias
- Vomiting
- Altered mental status (Janezic, 2013)

Intraoperatively, signs and symptoms could be masked by anesthesia (Janezic, 2013). Most commonly diagnosed post operatively or not at all.

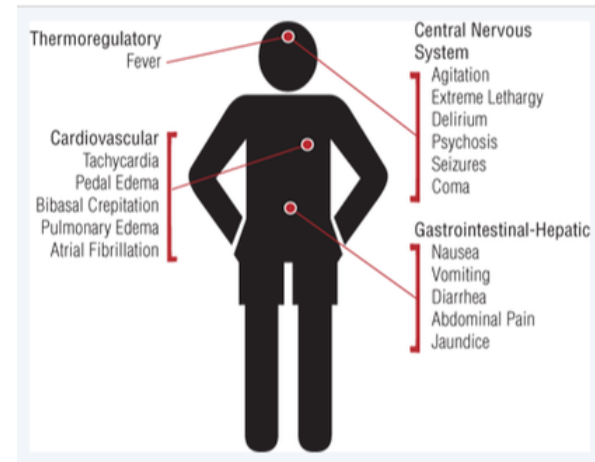
There is no universally accepted criteria to diagnose but the Burch-Wartofsky Point Scale (BWPS) can be helpful to assess severity and guide treatment, shown above (Ji, 2017).

Implementations for Nursing Care

- Perioperative screening for thyrotoxicosis
- Cardiac monitoring
- Waiting 6-8 weeks for anti-thyroid drugs to become effective prior to elective cases
- Frequent lab monitoring
- Frequent mental status screening post-operatively (Schreiber, 2017)
- Management (Leung, 2016):
 - Antithyroid drugs such as propylthiouracil and methimazole
 - Saturated solution of potassium iodide
 - Glucocorticoids
 - Beta-blocker therapy
 - Supportive measures such as IV fluids, oxygen, cooling and treatment of any precipitating causes

Conclusion

Thyroid storm is an endocrine emergency that requires a rapid response. Prevention measures could include careful pre operative screening, watching closely for the signs and symptoms intraoperative and close monitoring post operatively. If left untreated, Thyroid Storm could lead to mortality or significant morbidity such as brain injury, cerebrovascular disease, muscle atrophy, renal impairment and long-term psychosis (Chiha, Samarasinghe & Kabaker, 2015).



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Schreiber, M. L. (2017). Thyroid storm. *MEDSURG Nursing*, 26(2), 143-145. Retrieved from <http://ezoroxv.otterbein.edu/login?url=http://search.ebscohost.com.ezoroxv.otterbein.edu/login.aspx?direct=true&db=r7h&AN=127315821&site=eds-live&scope=site>



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