

ANESTHESIA FOR HYPOTHYROIDISM

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The thyroid hormones have a wide variety of actions in virtually every organ system of the body . They play a crucial role in regulating important functions such as cardiac contractility , vascular tone , water and electrolyte balance and normal function of the central nervous system .

Disease of thyroid gland is common . For eg . in endemic areas the incidence of goiter is 15 -30 % of the total population . It is now accepted that an euthyroid state marked by adequate levels of thyroid hormone is necessary to obtain the best possible results from any kind of surgical intervention .

PHYSIOLOGY

The thyroid secretions are predominantly thyroxine (T₄) and only a small amount of triiodothyronine (T₃). Approximately 85 % of T₃ is produced by monodeiodination of T₄ in tissues like liver , muscle and kidney . T₄ is probably not metabolically active until converted to T₃ and may be regarded as a prohormone . . T₃ and T₄ circulate in the plasma almost entirely bound to (> 99.9 %) to transport proteins mainly thyroxine binding globulin (TBG) . It is the minute fraction of unbound or free hormone which diffuses into tissues and exerts its metabolic actions .

Production of T₃ and T₄ in thyroid is stimulated by thyrotropin (thyroid stimulating hormone TSH), a glycoprotein released from the thyrotropin cells of the anterior pituitary in response to the thyrotropin releasing hormone (TRH) . There is a negative feedback of the thyroid hormones on the thyrotrophs , such that in hyperthyroidism when the plasma concentrations of T₃ and T₄ are raised TSH secretion is suppressed and in hypothyroidism due to the disease of the thyroid gland , T₃ and T₄ are associated with high concentrations of TSH levels .

Normal T₃ – 60 – 175 ng / dl

Normal T₄ – 4 – 11 ug /dl

Normal TSH – 0.3 – 4 Miu/l

HYPOTHYROIDISM

Hypothyroidism is a generic term for all conditions in which body tissues are exposed to decreased concentrations of T₃ and T₄ .

Types of hypothyroidism

- 1 . Primary hypothyroidism
- 2 . Secondary Hypothyroidism

Primary Hypothyroidism is due to destruction of thyroid gland and secondary due to dysfunction of CNS .

Etiology of Hypothyroidism

Primary Hypothyroidism

Thyroid gland dysfunction

- 1 . Hashimotos thyroiditis
- 2 . Previous subtotal thyroidectomy
- 3 . Radioactive iodine therapy
- 4 . irradiation of the neck

Thyroid hormone deficiency

- 1 . Antithyroid drugs
- 2 . excess iodide
- 3 . dietary iodine deficiency

Secondary Hypothyroidism

- 1 . Hypothalamic dysfunction
- 2 . TRH deficiency
- 3 . Anterior pituitary dysfunction
- 4 . TSH deficiency

Characteristics of Hypothyroidism

- 1 . Lethargy
- 2 . Cold intolerance
- 3 . Constipation
- 4 . Dry hair
- 5 . Goitre

- 6 . Hyperlipedemia
- 7 . Hypertension
- 8 . Anemia
- 9 . Cardiomegaly
- 10 . Parasthesia
- 11 . Decreased cardiac output
- 12 . Decreased respiratory rate
- 13 . Seizures
- 14 . Weight gain

Diagnosis of Hypothyroidism

	T3(60 – 175ng /dl)	T4 (4 – 11 ug / dl)	TSH (0.3-4Miu/l)	THBR
Primary hypothyroidism	Low	Low	High	Low
Secondary hypothyroidism	Low	Low	Low	Low
Sick euthyroid syndrome	Low	Normal	Normal	Normal
Pregnancy	Normal	Elevated	Normal	low

Myxedema coma results from extreme hypothyroidism and characterized by impaired mentation , hypoventilation , hypothermia , hyponatremia (from inappropriate ADH secretion)and congestive cardiac failure . It is a medical emergency . It is more common in the elderly and may be precipitated by infection , surgery or trauma . Myxedema coma is life threatening .

Treatment of Hypothyroidism

Consists of oral administration of T4 . Tab . L – Thyroxine is started over a dose of 50 ug initially and increased over a period of weeks to 300 – 500 ug . Optimal therapy is characterized by the disappearance of all symptoms of hypothyroidism and normal plasma TSH level .

Patients with IHD and hypothyroidism may not tolerate even modest amount of T4 without the development of angina . Hence this drug is started at a lower dose of 12. 5 ug – 25 ug and increased over a period of months with ECG monitoring .

Treatment of Myxedema coma

IV Thyroid hormone Loading dose of T3 or T4 (300 – 500 ug of levothyroxine iodine in patients without heart disease) followed by a maintenance infusion (eg . 50 ug of levothyroxine per day)

Steroid replacement eg . 100 mg hydrocortisone IV every 8 th hourly

Supportive therapy with IV fluids , thermoregulation , correction of electrolytes and cardiorespiratory support by mechanical ventilation

PREOP ASSESSMENT

All the basic investigations to be routinely done including thyroid function tests

ECG

X Ray chest

ECHO

Electrolytes

Blood grouping and Typing

Airway assessment

ANESTHETIC CONSIDERATIONS

Anesthesia selection and maintenance depends on disease severity

Patients with uncorrected severe hypothyroidism ($T_4 < 1 \text{ ug / dl}$) or myxedema coma should not undergo elective surgery and should be treated with thyroid hormones prior to emergency surgery .

While a euthyroid state is ideal , mild to moderate hypothyroidism does not appear to be an absolute contraindication for surgery .

Considering the problem of subclinical hypothyroidism in many patients who undergo uneventful anesthesia , as well as lack of increased morbidity in patients with mild to moderate hypothyroidism , there is little evidence to support delayed elective surgery .

PREOP MEDICATION

Preoperative medication should emphasise the value of preoperative visit and resultant Premedication with histamine H2 antagonists and metoclopramide should be considered because of the slowed gastric emptying ..

Opioid premedication has been administered safely , but there is a concern that the depressant effects of these drugs may be exaggerated in the hypothyroid patients .

Patients who have been rendered euthyroid may require their usual doses of thyroid hormones on the day of surgery .

Supplemental cortisol has been considered if there is a concern that the surgical stress could unmask decreased adrenal function that accompanies hypothyroidism .

psychological support .

Hypothyroid patients do not require much preoperative sedation and may be prone to drug induced hypotension .

INDUCTION OF ANESTHESIA

Often accomplished with the IV administration of ketamine , with the idea that the support of CVS by this drug is beneficial .

Thiopentone has also been used in the induction of anesthesia in the hypothyroid without apparent excessive cardiovascular depression .

In severely hypothyroid patients inhalation of N2O may be sufficient to produce unresponsiveness.

Intubation is facilitated by succinylcholine or a nondepolarising relaxant . The fact that the coexisting skeletal muscle weakness could be associated with exaggerated muscle relaxant effect should not be forgotten .

MONITORING

Along with the routine monitoring of NIBP , PR , O2 saturation , and electrical activity of the heart continuous monitoring of the blood pressure with a catheter placed in the peripheral artery as well as measurement of cardiac filling pressures is recommended for invasive operation .

Monitoring of the hypothyroid patient is directed at the prompt recognition of exaggerated cardiovascular depression reflecting the onset of CCF and detection of onset of hypothermia .

Measurement of CVP is helpful for guiding the fluid administration .

MAINTENANCE OF ANESTHESIA

Maintenance of anesthesia is often done by the inhalation of N₂O plus supplementation along with short acting opioid like fentanyl if needed .

Volatile anesthetic should be used with extreme caution in overtly symptomatic hypothyroid patients for fear of exaggerated cardiovascular depression. And vasodilation produced by any anesthetic drug in the presence of hypovolemia or attenuated baroreceptor reflexes responses or both could result in abrupt hypotension .

Maintaining skeletal muscle paralysis to provide adequate surgical working conditions and minimization of the dose of anesthetic drug is the goal of management of hypothyroid patients. Pancuronium is a preferable choice of NDMR due to mild CVS stimulating effect of the drug .

Controlled ventilation is recommended in view of hypoventilation . Care should be taken to avoid excessive decrease in PACO₂ due to decreased production of CO₂ associated with decrease in BMR .

Reversal of the non – depolarizing neuromuscular blockade with an anticholinesterase combined with anticholinergic drug does not pose a hazard to the hypothyroid patients . Prolonged post operative observation is needed as the sedative effects of drugs may be delayed . Prolonged somnolence and inability to wean from mechanical ventilation have been described in patients with undiagnosed hypothyroidism

POSTOPERATIVE MANAGEMENT

Recovery from general anaesthesia may be delayed by hypothermia, respiratory depression or slowed drug biotransformation .These patients require prolonged mechanical ventilation .Patients should remain intubated until awake.

Removal of the tracheal tube is deferred until the patient is responding appropriately and body temperature is close to 37 degrees .

Concern about possible increase in the effect of opioid is a consideration in the management of postoperative pain . because hypothyroidism increases the vulnerability to respiratory depression A non opioid such as ketorolac would be a good choice for postoperative pain relief

If emergency surgery is indicated the potential for severe intraoperative cardiovascular

Instability and myxoedema coma in postop period is high Special consideration when anaesthetizing myxoedematous patients have been described. Serious complication include

prolonged coma and cardiorespiratory arrest complication occur in patients who are either preoperatively undiagnosed or untreated. The surgery can be postponed for 24 to 48 hours iv thyroxine replacement more effective Intravenous l thyroxine 300-500mcg takes 10 to 12 days to yield peak metabolic effect intravenous T3 25 to 50 mcg is effective in 6hrs with basal metabolic rate seen in 36 to 72 hrs. This is followed by a maintenance infusion. glucose containing iv fluids to be infused, along with temperature regulation and correction of electrical imbalance. IV hydrocortisone 100 to 300mg/day is given to treat adrenal insufficiency

The hypothyroid patients tend to develop hypothermia because of diminished or absent calorogenic response to catecholamine. All efforts should be taken to protect the body temperature intraoperatively

REGIONAL ANESTHESIA

Regional anesthesia is an appropriate selection for the hypothyroid patients . It is very important to maintain intravascular fluid volume during regional anesthesia . Hypothyroid patients are predisposed to drug toxicity due to decreased metabolism of amide local anesthetics that is absorbed into the systemic circulation . Hence theoretically the dose of local anesthetic for performing a peripheral nerve block in hypothyroid patients could be decreased .