

# Episode 183: Thyroid Keywords

On this episode: Drs. Gillian Isaac and Jed Wolpaw

In this 183rd episode I welcome back Dr. Gillian Isaac to do another keyword episode where we review the ABA keyword topics of Thyroid for the Basic Exam and Thyroid for the Advanced Exam.

[All Keyword Episodes](#)

## Questions & Notes

Click → jump to answers/notes.

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### KEY POINT 1: THYROID ANATOMY

**What is vertical extension of thyroid relative to vertebrae?**

**Posterior medial aspect of thyroid bone attached to?**

- A. Cricoid cartilage
- B. Arytenoid cartilages
- C. Corniculate
- D. Thyroid

**Which following most likely associated w/ cannulation of LEFT IJV?**

- A. Longer RLN
- B. Lower cupula of pleura
- C. Anterior location of phrenic nerve
- D. Presence of thoracic duct

### KEY POINT 2: ANATOMICAL RELATIONSHIPS

**63F sustained injury of RLN during thyroidectomy. Most likely postop sign?**

- A. AD-duction of cord
- B. Aponia
- C. Aspiration d/t glottic incompetence
- D. Impaired cough

**Coughing that occurs during awake intubation prevented by local block at which nerve?**

- A. Glossopharyngeal nerve (GPN)
- B. Hypoglossal nerve
- C. RLN and GPN
- D. RLN and SLN
- E. SLN and GPN

### KEY POINT 3: THYROID HORMONES

**Which of following describes thyroid hormone?**

- A. Released from anterior pituitary
- B. Binds to receptors on outside of cell
- C. Derived from cholesterol
- D. Binds to receptor on inside of cell

### KEY POINT 4: THYROID HORMONE PRODUCTION

**What enzyme is used to form T3 or T4?**

**What protein is T3 or T4 bound to in colloid?**

**Release of T3 or T4 occurs via proteolytic lysis of thyroglobulin and diffusion into circulation**

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**KEY POINT 5: THYROID STIMULATING HORMONE**

27F scheduled for foot surgery under GA. Hx of subtotal thyroidectomy 3yrs ago. Takes Synthroid. Which lab test most useful in evaluating euthyroid?

- A. T4
- B. T3
- C. TSH
- D. Resin T3 uptake
- E. Radioactive iodine

**BASIC EXAM TOPICS****ADVANCED EXAM TOPICS****KEY POINT 1: HYPERTHYROIDISM****Hyperthyroidism**

- A. High levels of T3/T4/TSH
- B. Most caused by Graves
- C. ↑ MAC requirements
- D. Thyroid surgery is first line treatment

**KEY POINT 2: MEDICAL MANAGEMENT OF HYPERTHYROIDISM****Methimazole reduce serum concentration of T3 by**

- A. Accelerate metabolism of T3
- B. Inhibit proteolysis of TBG
- C. Inhibit secretion of TSH
- D. Inhibit uptake of iodine by thyroid cells
- E. Prevent addition of iodine to tyrosine resins on TGB

**Which of following considered ablative therapy for thyrotoxicosis due to Graves**

- 1. Thyroidectomy
- 2. MTU
- 3. Radioactive iodine
- 4. Propranolol

**KEY POINT 3: HYPOTHYROIDISM****Patient with Hashimoto disease has labs drawn. Which most consistent?**

- A. High T3/T4/TSH
- B. High T3/T4, low TSH
- C. Low T3/T4/TSH
- D. Low T3/T4, high TSH
- E. High T3/T4, normal TSH

**65M w/ hypothyroid undergoing emergent appendectomy. Which findings most likely?**

- A. ↓ MAC of isoflurane
- B. ↓ contractility
- C. ↓ response to catecholamine
- D. ↑ baroreceptor reflex

**What hormone produced in peripheral tissue when levothyroxine administered?**

- A. Methimazole
- B. T3
- C. T4
- D. TSH
- E. FSH

**Pt with moderate hypothyroidism and unstable angina requires urgent CABG. Most appropriate step?**

- A. Start epi infusion
- B. IM barbiturate

- 
- C. IV T3
  - D. IV T4
  - E. Treat MI

**Which of following most likely in 30y/o w/ untreated hypothyroid?**

- A. Cardiac arrhythmia w/ ketamine administration
- B. ↓ ventilatory response to hypoxia
- C. Hypoglycemia
- D. ↑ MAC if inhaled
- E. Peripheral vasodilation

#### KEY POINT 4: THYROID STORM

**40F w/ Graves undergoing thyroidectomy w/ 1% iso, 60% n2o, o2. While manipulating thyroid temp increases to 38.5°, HR to 160, BP 150/100. Most appropriate initial tx?**

- A. Dantrolene
- B. Potassium
- C. Propranolol
- D. PTU
- E. Increase concentration of isoflurane

#### KEY POINT 5: THYROID STORM TX

**38F w/ hyperthyroid undergoing ORIF humerus w/ isoflurane. HR ↑ to 120, occasional PVCs. Most appropriate next step?**

- A. Stop isoflurane
- B. Edrophonium
- C. Esmolol
- D. Lidocaine
- E. PTU

**Which of following tx should not be used in mgt of thyroid storm?**

- A. ASA
- B. Cold crystalloid
- C. Cholestyramine
- D. Dexamethasone
- E. Esmolol

#### KEY POINT 6: THYROID SURGERY COMPLICATIONS

**50F undergoes subtotal thyroidectomy for Graves. In immediate postop period, has marked hoarseness, no stridor. Most likely trauma to?**

- A. External branch of SLN
- B. Internal branch of SLN
- C. RLN
- D. GPN
- E. Vocal cords

**If both RLN severed, most likely finding?**

- A. Paralysis of cricothyroid muscle
- B. Cadaveric positioning of true vocal cords
- C. Anesthesia of bilateral epiglottis
- D. Bilateral pure adductor cord paralysis

**28F thyroidectomy. Left RLN transected. Which finding most likely?**

- A. Normal voice
- B. Aphonia
- C. Hoarseness
- D. Expiratory stridor
- E. Inspiratory stridor

**54F thyroidectomy under GA. Pt awakened, and intact RLN demonstrated. ETT removed. 2 days later, pt has severe stridor and upper airway obstruction. Most likely cause?**

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- 
- A. Damage to RLN
  - B. SLN
  - C. Tracheomalacia
  - D. Hypocalcemia
  - E. Hematoma

**Each post op complication from thyroid surgery results in upper airway obstruction except?**

- A. Tracheomalacia
- B. Tetany
- C. Cervical hematoma
- D. Bilateral RLN
- E. Bilateral SLN injury

**36F acute airway obstruction after total thyroidectomy. Most likely cause?**

- A. Bilateral RLN injury
- B. Unilateral RLN injury
- C. Hypocalcemia
- D. Subglottic edema
- E. Tracheomalacia

**REFERENCES**

**RANDOM RECS**

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## Key Point 1: Thyroid anatomy

2:57

- Anterior Neck C5-T1
- Two endocrine glands connected by isthmus

### What is vertical extension of thyroid relative to vertebrae?

3:15

- C5-T1
- Lots of anatomy in this area!
  - o Cricothyroid
  - o Recurrent laryngeal nerve (RLN)
  - o Stellate ganglion

### Posterior medial aspect of thyroid bone attached to?

4:00

A. Cricoid cartilage

B. Arytenoid cartilages

C. Corniculate

D. Thyroid

- Discussion
  - o Doesn't go all the way back, so probably not D
  - o Answer = A

### Which following most likely associated w/ cannulation of LEFT IJV?

4:47

- A. Longer RLN
- B. Lower cupula of pleura
- C. Anterior location of phrenic nerve
- D. Presence of thoracic duct

- Discussion
  - o RLN longer on right
  - o Answer D

## Key Point 2: Anatomical Relationships

6:03

- Posterolateral to thyroid
  - o Carotid artery
  - o Internal jugular
  - o Vagus nerve
- Posteromedial to thyroid
  - o Superior laryngeal nerve (SLN)

- RLN
- Important especially in advanced exam where local anatomy relates to complications with thyroid surgery

### 63F sustained injury of RLN during thyroidectomy. Most likely postop sign?

7:07

- A. AD-duction of cord
- B. Aphonia
- C. Aspiration d/t glottic incompetence
- D. Impaired cough
- Discussion
  - RLN relaxes cord, so if it's cut, then there will be tension = AD-duction
  - This question is from ABA sample!
  - Answer = A

### Coughing that occurs during awake intubation prevented by local block at which nerve?

8:36

- A. Glossopharyngeal nerve (GPN)
- B. Hypoglossal nerve
- C. RLN and GPN
- D. RLN and SLN
- E. SLN and GPN
- Discussion
  - Need RLN to cover cords
  - Recall SLN is sensory
  - GPN relates to gag reflex
  - Answer = D

### Key Point 3: Thyroid hormones

9:37

- Thyroid gland → thyroid hormone (T4 + T3)
- Major regulator of cellular and metabolic activity
- Necessary for cardiopulmonary and neurologic functions

### Which of following describes thyroid hormone?

10:19

- A. Released from anterior pituitary
  - B. Binds to receptors on outside of cell
  - C. Derived from cholesterol
  - D. Binds to receptor on inside of cell
- Discussion
    - o Strategy: see B or D opposite, so answer is one of these
    - o Answer = D

## Key Point 4: Thyroid Hormone Production

12:25

- Uptake and concentration of iodide in gland → bound to tyrosine residues to form various iodo-tyrosines
- Organification via thyroperoxidase (TPO) to T3 or T4 which binds to thyroglobulin (TGB), then stored

What enzyme is used to form T3 or T4?

12:53

- TPO

What protein is T3 or T4 bound to in colloid?

13:05

- Thyroglobulin

Release of T3 or T4 occurs via proteolytic lysis of thyroglobulin and diffusion into circulation

13:09

## Key Point 5: Thyroid Stimulating Hormone

13:45

- TSH released from anterior pituitary → stimulate thyroid uptake of iodine and proteolytic release of thyroid hormones (TH)
- Excess iodine inhibits secretion and synthesis of TH
- Circulating TH inhibits TRH and TSH

27F scheduled for foot surgery under GA. Hx of subtotal thyroidectomy 3yrs ago. Takes Synthroid. Which lab test most useful in evaluating euthyroid?

14:00

- A. T4
- B. T3
- C. TSH
- D. Resin T3 uptake
- E. Radioactive iodine
  - Discussion
    - o Clinically, we check TSH.

## Basic Exam Topics

- Anatomy
- T3/T4/TSH, and lab testing
- RLN injury
- Basics of hypo/hyperthyroidism

## Advanced Exam Topics

15:21

### Hyperthyroidism

- Metabolic and circulatory effects
- Anesthetic effects
- Thyroid storm

### Hypothyroidism

- Metabolic and circulatory effects
- Myxedema coma
- Substitution therapy
- Anesthetic implications

### Complications of surgery

- RLN injury, diagnosis, treatment

### Commonly tested per OpenAnesthesia

- Hyperthyroidism, Thyrotoxicosis
- Thyroid storm
- Thyroid surgery and RLN monitoring
- Complications from thyroidectomy
- Hyperthyroidism Labs

### Most likely tested per Dr. Isaac

41:36



- Hypo/hyperthyroidism, especially anesthetic management
- Thyroid storm recognition and treatment
- Postop complications of thyroid surgery, timing

## Key Point 1: Hyperthyroidism

16:47

- Results in excessive exposure of tissues to TH
- Most common cause = Graves' Disease
- Low TSH
- High T3/T4
- Manifestations
  - o Weight loss
  - o Diarrhea
  - o Muscle weakness
  - o ↑ EF, HR
- Goal prior to surgery
  - o Reach euthyroid bc of risk for thyroid storm
  - o If mild, not as bad

## Hyperthyroidism

17:46

- A. High levels of T3/T4/TSH
- B. Most caused by Graves
- C. ↑ MAC requirements
- D. Thyroid surgery is first line treatment
- Discussion
  - o Answer = B
  - o A: TSH is inverse
  - o C: No effect
  - o D: Medicine first

## Key Point 2: Medical Management of Hyperthyroidism

18:53

- Both inhibit synthesis of TH
  - o Propylthiouracil (PTU)
    - Also reduce peripheral conversion of T4 to T3 (which is more active)
  - o Methimazole

## Methimazole reduce serum concentration of T3 by

19:27

- A. Accelerate metabolism of T3
  - B. Inhibit proteolysis of TBG
  - C. Inhibit secretion of TSH
  - D. Inhibit uptake of iodine by thyroid cells
  - E. Prevent addition of iodine to tyrosine resins on TGB
- Discussion
    - o Answer = D

Which of following considered ablative therapy for thyrotoxicosis due to Graves  
20:33

Historic K-type question

1. Thyroidectomy
  2. MTU
  3. Radioactive iodine
  4. Propranolol
- A: 1,2,3
  - B: 1,3
  - C: 2,4
  - D: only 4
  - Discussion
    - o Ablative NOT propranolol, can intuit not MTU
    - o Answer = B
    - o

### Key Point 3: Hypothyroidism

21:53

- Due to inadequate T3/T4
- Most common cause: iatrogenic, autoimmune
- Manifestations
  - o Lethargy
  - o Cold intolerance
  - o ↓ cardiac output, bradycardia
- Not as important to aggressively treat hypothyroidism – can go to OR in mild – mod severity
- Goal still euthyroid

Patient with Hashimoto disease has labs drawn. Which most consistent?

22:40

- A. High T3/T4/TSH
  - B. High T3/T4, low TSH
  - C. Low T3/T4/TSH
  - D. Low T3/T4, high TSH
  - E. High T3/T4, normal TSH
- Discussion
- Hypothyroid = high TSH
  - Inverse relationship, so answer is D

65M w/ hypothyroid undergoing emergent appendectomy. Which findings most likely?

23:46

- A. ↓ MAC of isoflurane
  - B. ↓ contractility
  - C. ↓ response to catecholamine
  - D. ↑ baroreceptor reflex
- Discussion
- On ABA sample!
  - Not MAC
  - Discussed ↑ contractility in hyper, so opposite for hypo = answer is D

What hormone produced in peripheral tissue when levothyroxine administered?

24:44

- A. Methimazole
  - B. T3
  - C. T4
  - D. TSH
  - E. FSH
- Discussion
- Synthroid is T4 which is peripherally converted to T3, answer = B

Pt with moderate hypothyroidism and unstable angina requires urgent CABG. Most appropriate step?

25:09

- A. Start epi infusion
  - B. IM barbiturate
  - C. IV T3
  - D. IV T4
  - E. Treat MI
- Discussion
- In this scenario, pt needs urgent procedure to survive, which pushes towards E

- Mild to mod hypothyroid doesn't need treatment
- Make sure to read full question!

Which of following most likely in 30y/o w/ untreated hypothyroid?

26:40

- A. Cardiac arrhythmia w/ ketamine administration
  - B. ↓ ventilatory response to hypoxia
  - C. Hypoglycemia
  - D. ↑ MAC if inhaled
  - E. Peripheral vasodilation
- Discussion
- Get rid of MAC
  - Answer = B
  - Not likely E because would see significant hypotension

## Key Point 4: Thyroid Storm

28:06

- Life threatening exacerbation of hyperthyroidism
- Most commonly due to untreated or undiagnosed hyperthyroid in setting of surgical stress
- Actively operating on hyperthyroid and manipulate thyroid gland with subsequent release of hormones
- Manifestations
  - Hyperthermia, tachyarrhythmias, MI
  - Agitated/confusion
  - Always have differential for this presentation
    - Thyroid storm
    - Malignant Hyperthermia
    - Pheochromocytoma
    - Neuroleptic Malignant Syndrome
    - Also sepsis, hypoxia, anesthesia

40F w/ Graves undergoing thyroidectomy w/ 1% iso, 60% n2o, o2. While manipulating thyroid temp increases to 38.5°, HR to 160, BP 150/100. Most appropriate initial tx?

29:20

- A. Dantrolene
- B. Potassium
- C. Propranolol
- D. PTU
- E. Increase concentration of isoflurane
- Discussion
  - E: Light anesthesia – increase iso? Most likely deep given settings
  - Graves – high risk of thyroid storm. Want to act quick. PTU wouldn't be as fast as propranolol. Answer = C
  - If no Graves hx, may go down MH route
  - Tx for thyroid storm is Na-Iodide

## Key Point 5: Thyroid Storm Tx

31:53

- If suspect,
  - IV fluids
  - Beta-blocker (10-40mg propranolol)
  - Sodium iodide (250mg q6h)
  - PTU (NGT 200-400mg )
  - Supportive
- If in doubt, call endocrinologist

38F w/ hyperthyroid undergoing ORIF humerus w/ isoflurane. HR ↑ to 120, occasional PVCs. Most appropriate next step?

33:59

- A. Stop isoflurane
- B. Edrophonium
- C. Esmolo;
- D. Lidocaine
- E. PTU
- Discussion
  - Tachy → possible thyroid storm. Give BB first

Which of following tx should not be used in mgt of thyroid storm?

35:01

- A. ASA
- B. Cold crystalloid
- C. Cholestyramine
- D. Dexamethasone
- E. Esmolol
- Discussion
  - o Answer = A. ASA worsens bc displaces TH from TBG

## Key Point 6: Thyroid Surgery Complications

36:00

- Timing is KEY
- Immediate: b/l RLN injury
- PACU: usually hematoma
- 2-3 days: hypocalcemia

50F undergoes subtotal thyroidectomy for Graves. In immediate postop period, has marked hoarseness, no stridor. Most likely trauma to?

36:40

- A. External branch of SLN
- B. Internal branch of SLN
- C. RLN
- D. GPN
- E. Vocal cords
- Discussion
  - o Most commonly injured nerve in thyroid surgery: answer = RLN
  - o Thus use NIMS tube to monitor
  - o Unilateral bc no stridor or difficulty breathing

If both RLN severed, most likely finding?

37:38

- A. Paralysis of cricothyroid muscle
- B. Cadaveric positioning of true vocal cords
- C. Anesthesia of bilateral epiglottis
- D. Bilateral pure adductor cord paralysis
- Discussion
  - o Severed = complete, not injury which causes pure adductor paralysis
  - o Severed → answer = B

28F thyroidectomy. Left RLN transected. Which finding most likely?

38:22

- A. Normal voice
  - B. Aphonia
  - C. Hoarseness
  - D. Expiratory stridor
  - E. Inspiratory stridor
- Discussion
- Answer = C per discussion above

54F thyroidectomy under GA. Pt awakened, and intact RLN demonstrated. ETT removed. 2 days later, pt has severe stridor and upper airway obstruction. Most likely cause?

38:43

- A. Damage to RLN
  - B. SLN
  - C. Tracheomalacia
  - D. Hypocalcemia
  - E. Hematoma
- Discussion
- Key is TIMING: 2 days later. Per discussion, would suspect hypocalcemia: answer = D
  - 24-96h after total thyroidectomy

Each post op complication from thyroid surgery results in upper airway obstruction except?

39:49

- A. Tracheomalacia
  - B. Tetany
  - C. Cervical hematoma
  - D. Bilateral RLN
  - E. Bilateral SLN injury
- Discussion
- Answer = E
  - Key is INJURY which causes complete obstruction, vs transection would cause partial obstruction
  - C in PACU
  - B from hypocalcemia
  - A from removing mass that may have stented airway open

36F acute airway obstruction after total thyroidectomy. Most likely cause?

41:10

- A. Bilateral RLN injury
- B. Unilateral RLN injury
- C. Hypocalcemia
- D. Subglottic edema
- E. Tracheomalacia
- Discussion
  - o Answer = C

## References

Barash Clinical Anesthesia 8th edition

American Board of Anesthesiology Website

Anesthesiahub.com

## Random Recs

Serious Eats Brown Butter Cookie Dough Recipe: [Link](#)

The Dragon Prince: [https://en.wikipedia.org/wiki/The\\_Dragon\\_Prince](https://en.wikipedia.org/wiki/The_Dragon_Prince)

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