



**The Lebanese Order of Pharmacists**  
26<sup>th</sup> Annual Congress

**Teaming Up for Excellence in Patient Care**  
**معاً للتميز في رعاية المريض**

# Thyroid Disorders: Patient Education on Hypothyroidism and Hyperthyroidism

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# Disclosure

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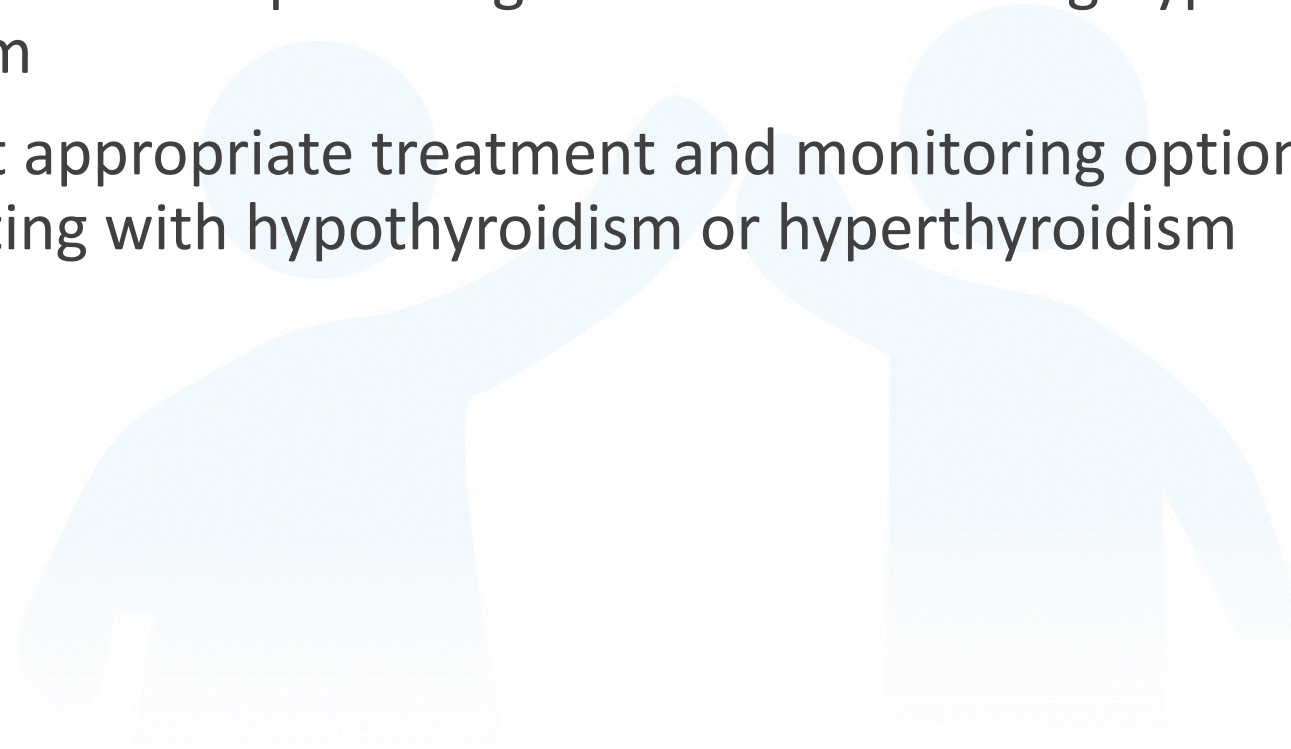
“Nisreen Mourad” declare to meeting attendees that there are no financial relationships with any for-profit companies that are directly or indirectly related to the subject of this presentation



# Learning Objectives

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- Differentiate between the symptoms and diagnostic criteria of hypothyroidism and hyperthyroidism
- Review the various therapeutic agents used in treating hypothyroidism and hyperthyroidism
- Select the most appropriate treatment and monitoring options for a given patient presenting with hypothyroidism or hyperthyroidism





# Outline

- Overview of Thyroid Hormones
- Definition
- Prevalence
- Risk Factors
- Symptoms
- Thyroid Function Tests
- Goals of Therapy
- Treatment Overview
- Hypothyroidism Management
- Hyperthyroidism Management
- Key Takeaways







## Case

- K.M. a 76-year-old woman presents to your clinic with symptoms of lethargy, weight gain, fatigue, constipation, dry skin, and intolerance to cold.
- In your office, her vital signs showed a temperature of 36°C, pulse of 58 beats/minute, and a blood pressure of 110/60 mm Hg.
- K.M.'s laboratory studies revealed a normal CBC with differential, total thyroxine (T4) concentration of 3.8 mcg/dL, and a thyroid-stimulating hormone (TSH) level of 12.2 mIU/L.
- K.M. has a history of hypertension and underwent a coronary artery bypass surgery 2 years ago.



# Overview of Thyroid Hormones

Affects the function of every organ



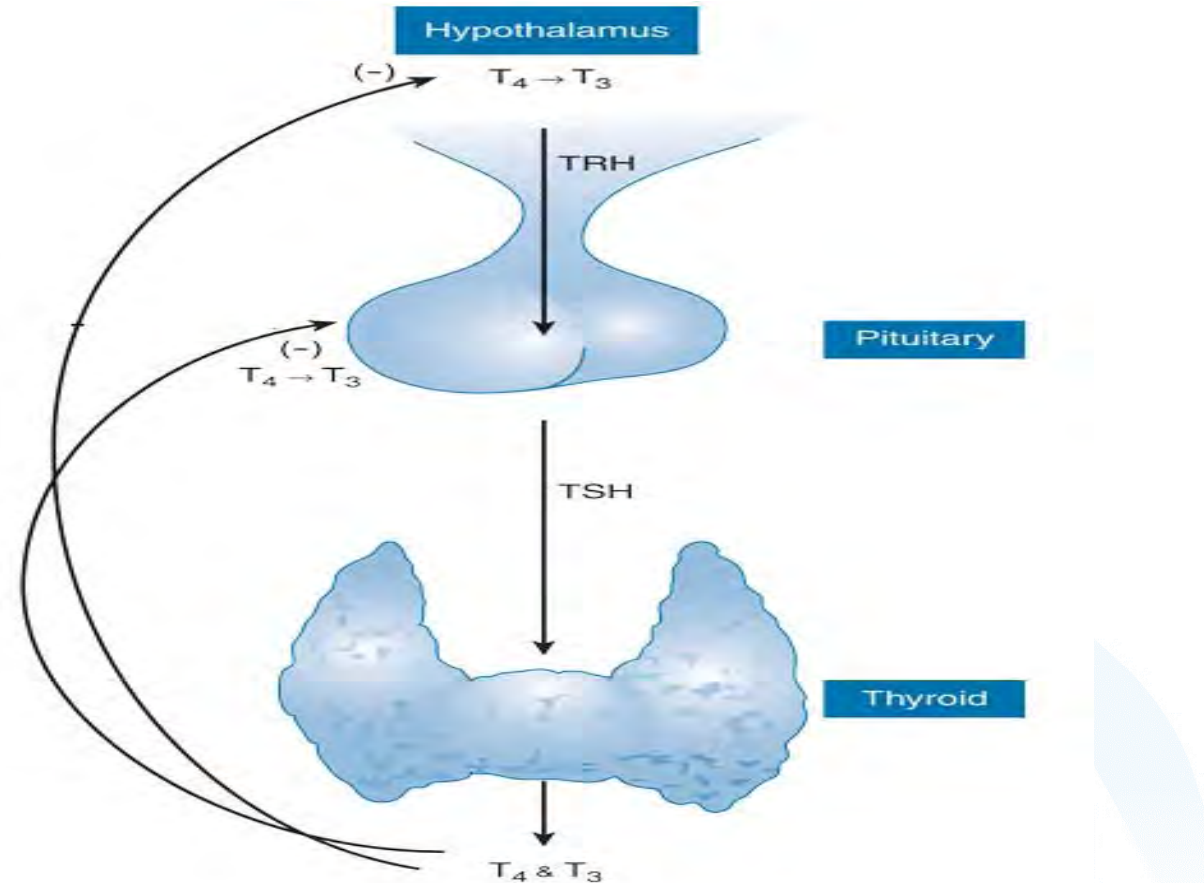
- Normal growth
- Normal development



- Maintain metabolic activity



# Overview of Thyroid Hormones *Cont'd*



**Figure 1. The hypothalamic-pituitary-thyroid axis**



# Definition

## Thyroid Disorders



### Hypothyroidism

- Occurs when the thyroid gland produces less than the normal amount of thyroid hormone(s)

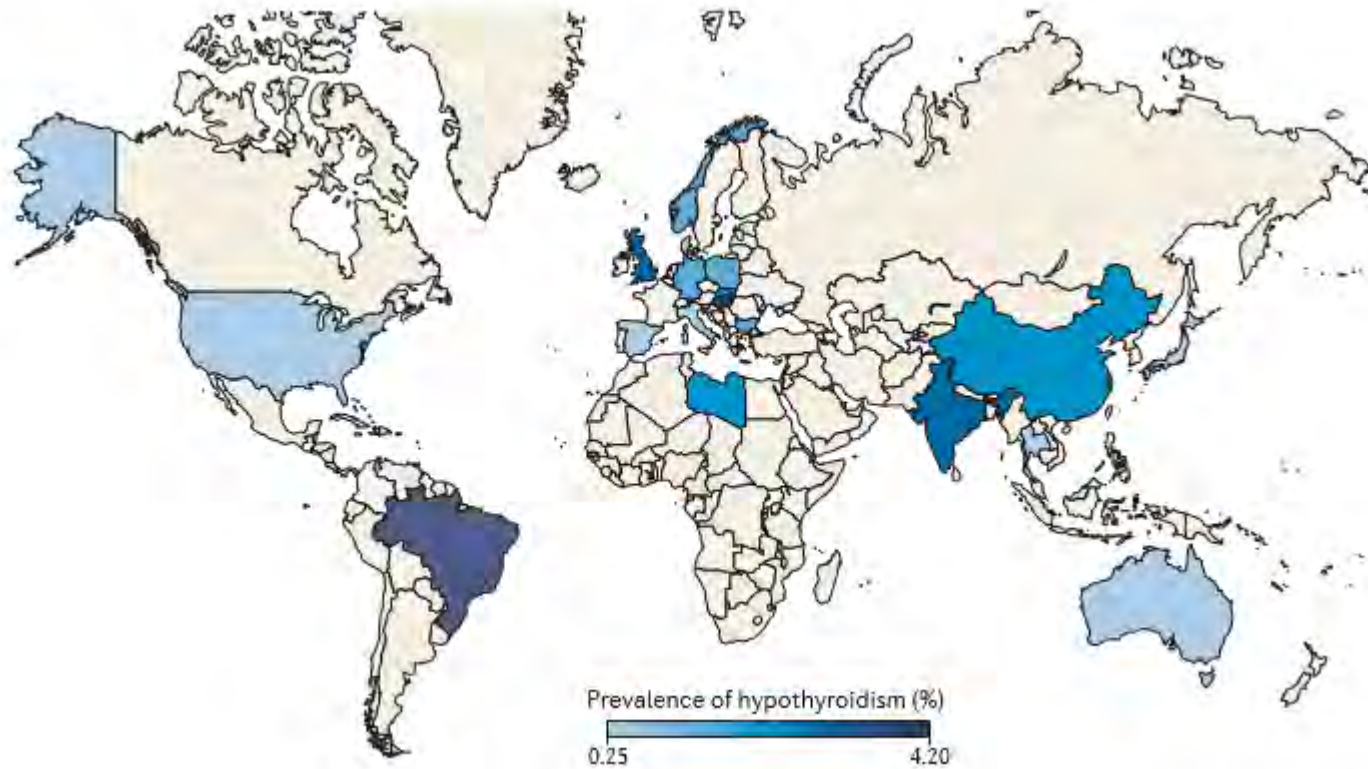
### Hyperthyroidism

- Occurs as a result of inappropriately high synthesis and/or secretion of thyroid hormone(s) by the thyroid gland





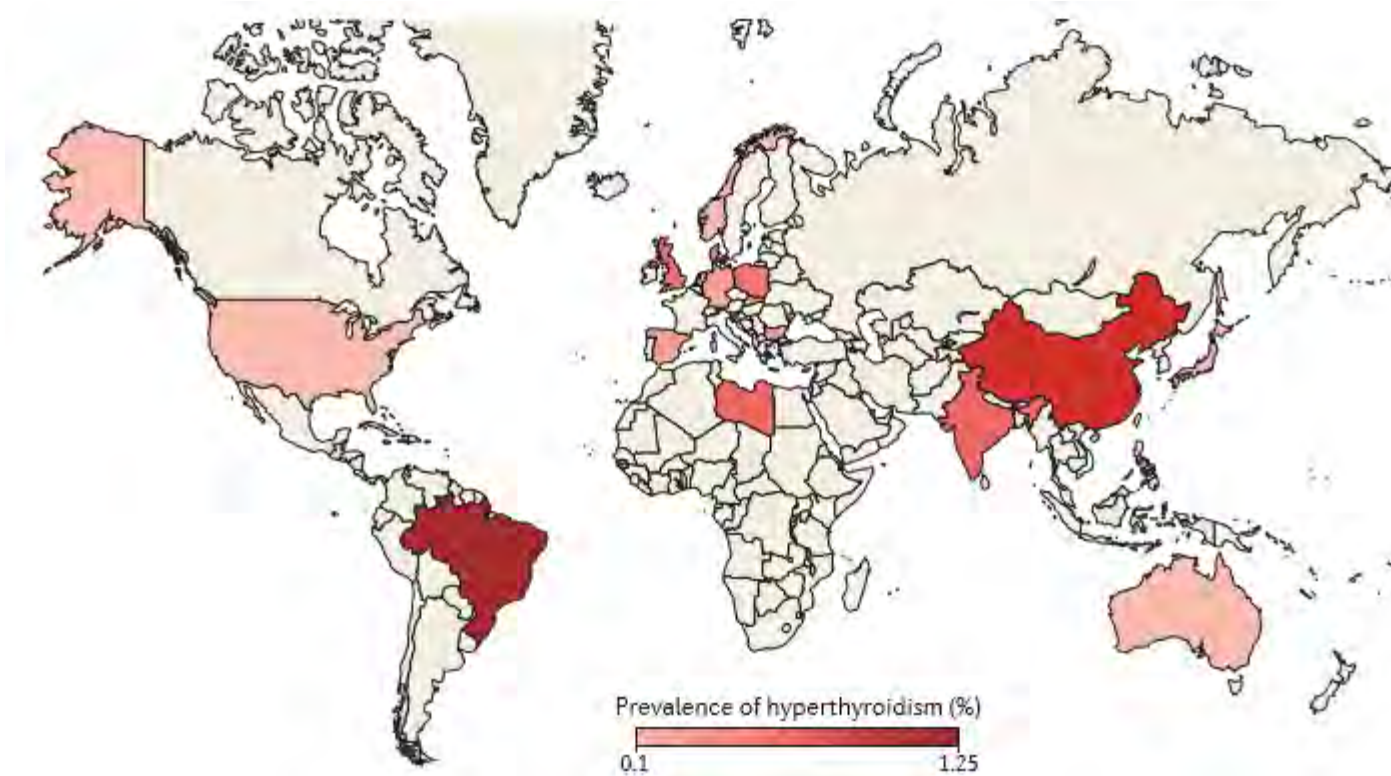
# Prevalence



**Figure 2. Map of overt hypothyroidism prevalence**



# Prevalence *Cont'd*



**Figure 3. Map of overt hyperthyroidism prevalence**

4. Taylor P, Albrecht D, Scholz A, Gutierrez-Buey G, Lazarus J, M. Dayan Colin, E. Okosieme O. Global epidemiology of hyperthyroidism and hypothyroidism. *Nature Reviews Endocrinology* 2018;14(5).



# Risk Factors

Risk Factor	Hypothyroidism	Hyperthyroidism
Female sex	+	+
Iodine deficiency/excess	+	+
Other autoimmune conditions	+	+
Genetic risk factors	NA	NA
Smoking	-	+
Alcohol	-	NA
Drugs	+	+
Infections	NA	NA

-: reduced risk  
+: increased risk  
NA: not applicable



# Symptoms

## Hypothyroidism

Bradycardia

Depression

Weight gain

Cold intolerance

Dry skin

Constipation



## Hyperthyroidism

Tachycardia

Anxiety

Weight loss

Heat intolerance

Moist skin

Diarrhea

5. El-Shafie KT. Clinical presentation of hypothyroidism. *J Family Community Med* **2003**;10(1):55-8.

6. De Leo S, Lee SY, Braverman LE. Hyperthyroidism. *Lancet* **2016**;388(10047):906-918.





## Case *Cont'd*

- What is K.M. suffering from?
  - A. Hypothyroidism
  - B. Hyperthyroidism





## Case *Cont'd*

- What is K.M. suffering from:
  - A. Hypothyroidism**
  - B. Hyperthyroidism





## Case *Cont'd*

- K.M. a 76-year-old woman presents to your clinic with symptoms of lethargy, weight gain, fatigue, constipation, dry skin, and intolerance to cold.
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# Thyroid Function Tests

Table 1. Thyroid Function Tests in Different Thyroid Conditions				
	Total T <sub>4</sub>	Free T <sub>4</sub>	Total T <sub>3</sub>	TSH
Normal	4.5-10.9 mcg/dL	0.8-2.7 ng/dL	60-181 ng/dL	0.5-4.7 mIU/L
Hypothyroid	↓↓	↓↓	↓	↑↑*
Hyperthyroid	↑↑	↑↑	↑↑↑	↓↓*

\*Primary thyroid disease





## Case *Cont'd*

- What are the laboratory tests that confirm the diagnosis of hypothyroidism?
  - A. Low T4, low TSH
  - B. High T4, low TSH
  - C. Low T4, high TSH
  - D. High T4, high TSH





## Case *Cont'd*

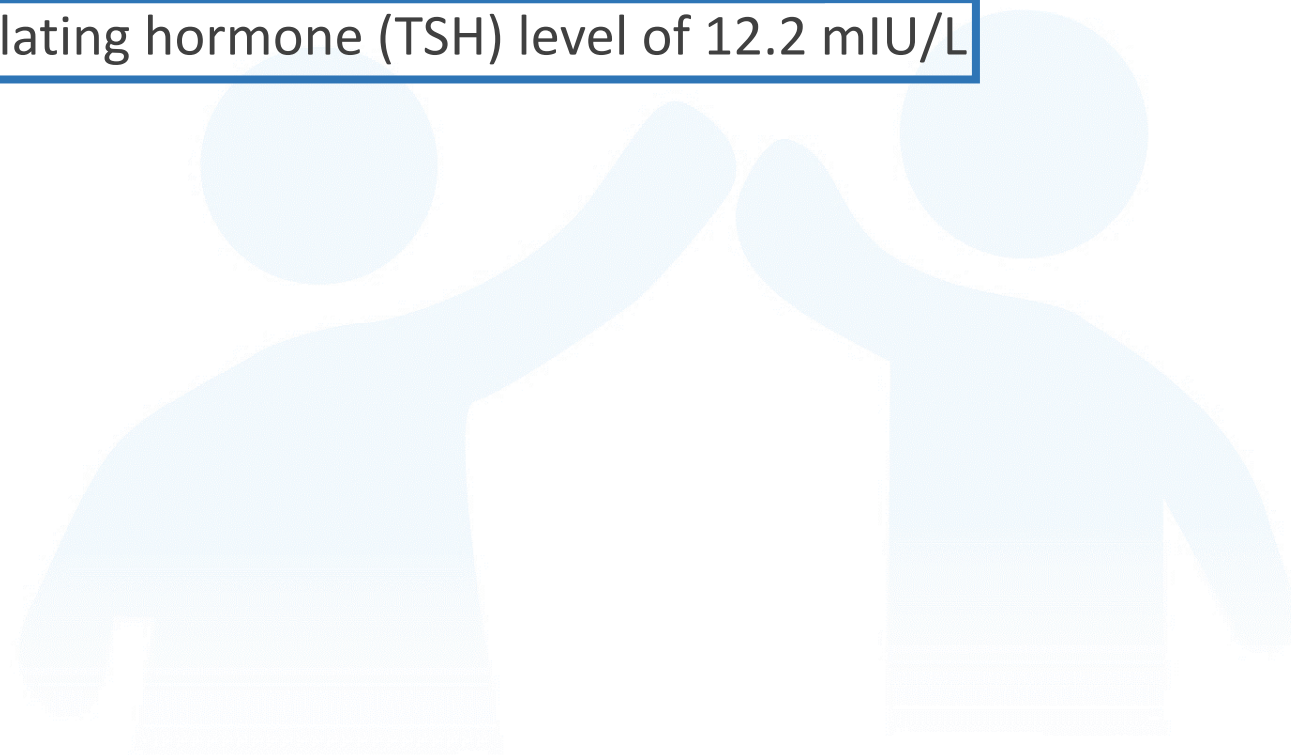
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## Case *Cont'd*

- K.M.'s laboratory studies revealed a:
  - Normal CBC with differential
  - Total thyroxine (T4) concentration of 3.8 mcg/dL
  - Thyroid-stimulating hormone (TSH) level of 12.2 mIU/L





# Goals of Therapy

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**Restore normal thyroid hormone concentrations in tissue**



**Provide symptomatic relief**



**Minimize the long-term consequences on organs**





# Treatment Overview

## Therapeutic Options



### Hypothyroidism

- Levothyroxine (T4; L-thyroxine)

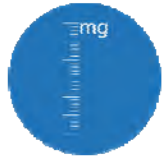
### Hyperthyroidism

- Antithyroid drugs
- Radioactive iodine (131I)-(RAI)
- Surgery



# Hypothyroidism Management

## Levothyroxine



- Once-daily dosing on an empty stomach
- Recommended dose: 1.6-1.7 mcg/kg/day

25 mcg/day    50 mcg/day



- Monitor TSH and T4 with therapy



- Excessive doses could lead to symptoms of hyperthyroidism



- Once a product is selected, therapeutic interchange should be discouraged



- Watch out for drug-drug interaction (example with cholestyramine, calcium carbonate, dietary fiber, carbamazepine, phenytoin)

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . McGraw-Hill Education 2016; United States of American.  
8. Garber JR, Cobin RH, Gharib H, Hennessey JV, Klein I, Mechanick JJ, Pessah-Pollack R, Singer PA, Woeber KA. Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. *Endocr Pract* 2012;18(6):989.



# Hyperthyroidism Management

## Antithyroid Drugs

Methimazole (MMI)

Propylthiouracil (PTU)

- **First-line treatment in:**
  - Children
  - Adolescents
  - Pregnancy
- **In radioactive iodine therapy or surgical resection:**
  - Awaiting for them
  - Not a candidate for them
  - After failure with them
- **Always start with MMI except in case of:**
  - First trimester of pregnancy
  - Thyroid storm
  - Minor reactions to MMI



# Hyperthyroidism Management *Cont'd*

## Antithyroid Drugs

Methimazole (MMI)

Propylthiouracil (PTU)

### ■ Action:

- Inhibit biosynthesis of thyroid hormones
- Exhibit immunosuppressive effects
- Inhibits peripheral conversion of T4 and T3 (PTU)





# Hyperthyroidism Management *Cont'd*

## Antithyroid Drugs

Methimazole (MMI)

Propylthiouracil (PTU)

### ■ Dosing:

- Patients with severe hyperthyroidism may require larger initial doses
- Changes in dose should be done on a monthly basis

### ■ Monitoring:

- T4
- TSH



# Hyperthyroidism Management *Cont'd*

## Antithyroid Drugs

Methimazole (MMI)

Propylthiouracil (PTU)

- **Side effects:**
  - Cutaneous reactions
  - Arthralgia, fever
- **Serious side effects:**
  - Hepatotoxicity
  - Agranulocytosis (most serious effect):
    - Characterized by fever, malaise, gingivitis, oropharyngeal infection, and a granulocyte count  $< 250/\text{mm}^3$
- **Case of relapse:**
  - Alternative therapy

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* **2016**; United States of American.  
9. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Endocr Pract* **2011**;17:456-520.



# Hyperthyroidism Management *Cont'd*

## Symptomatic Management

### Beta-Blockers

- **Action:**
  - Manage manifestations of hyperthyroidism (palpitations, anxiety, tremor, and heat intolerance)
  - Partially block the conversion of T4 to T3 (propranolol and nadolol)
- **Target:**
  - Heart rate <90 beats/min

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* **2016**; United States of American.  
9. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Endocr Pract* **2011**;17:456-520.



# Hyperthyroidism Management *Cont'd*

## Symptomatic Management

### Beta-Blockers

- **Used as adjunctive therapy:**
  - With antithyroid drugs
  - With RAI
  - In preparation for surgery

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* **2016**; United States of American.  
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# Hyperthyroidism Management *Cont'd*

## Symptomatic Management

### Beta-Blockers

- **Side effects:**
  - Nausea, vomiting, insomnia, light-headedness, bradycardia, and hematologic disturbances
- **Caution:**
  - Asthma and chronic obstructive pulmonary disease (COPD)-> Go for selective beta-blockers
- **In case of contraindication:**
  - Calcium channel blockers

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* **2016**; United States of American.  
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# Hyperthyroidism Management *Cont'd*

## Additional Drug

Iodide

- **Action, acutely:**
  - Inhibit thyroid hormone biosynthesis
  - Block thyroid hormone release
  - Decrease the size and vascularity of the thyroid gland
- **Prolonged use:**
  - Cause paradoxical increases in thyroid hormone release ->Aren't used in routine treatment of hyperthyroidism
- **Used as adjunctive therapy:**
  - In preparation for surgery
  - Following RAI



# Hyperthyroidism Management *Cont'd*

## Additional Drug

Iodide

### ■ Side effects:

- Hypersensitivity reactions
- Salivary gland swelling
- Iodism
- Gynecomastia



# Hyperthyroidism Management *Cont'd*

## Radioactive iodine (131I)-(RAI)

### First line for:

- Toxic nodules
  - Toxic multinodular goiter

### Action:

- *Initially:*
  - RAI incorporates into thyroid hormones
  - ↓
  - Disrupts their synthesis
- *Over weeks:*
  - The follicles that took up RAI develop cellular necrosis, breakdown, and destruction of the small vessels within the gland
  - ↓
  - Edema and fibrosis

### Contraindication:

- Pregnancy

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . McGraw-Hill Education 2016; United States of American.  
9. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Endocr Pract* 2011;17:456-520.



# Hyperthyroidism Management *Cont'd*

## Radioactive iodine (131I)-(RAI)

### Before:

- Antithyroid drug
- Beta-blocker

### During:

- RAI
- Beta-blocker

### After:

- Iodide (3 to 7 days afterwards)
- Beta-blocker
- Corticosteroids
- Levothyroxine

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* 2016; United States of American.  
9. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Endocr Pract* 2011;17:456-520.





# Hyperthyroidism Management *Cont'd*

## Radioactive iodine (<sup>131</sup>I)-(RAI)

### Side effects:

- Thyroidal tenderness
- Dysphagia

### Follow-up:

- T4, T3, and TSH:
  - Within the first 1–2 months
  - Then every 4- to 6-weeks for 6 months
  - Until the patient is hypothyroid and is stable on thyroid hormone replacement

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* 2016; United States of American.  
9. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Endocr Pract* 2011;17:456-520.





# Hyperthyroidism Management *Cont'd*

## Surgery

### First line for:

- Large thyroid gland (>80 g)
  - Cosmetic or pressure symptoms
  - Severe ophthalmopathy
- Lack of remission on antithyroid drugs

### Action:

- Removal of the hypersecreting thyroid gland

### Complications:

- Recurrence of hyperthyroidism
- Hypothyroidism
- Hypoparathyroidism
  - Vocal cord abnormalities

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* 2016; United States of American.  
9. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Endocr Pract* 2011;17:456-520.



# Hyperthyroidism Management *Cont'd*

## Surgery

### Before:

- Antithyroid drug (6 to 8 weeks)
- Iodide (10 to 14 days)
- Beta-blocker

### After:

- Beta-blocker (7 to 10 days)
- Levothyroxine

7. Jonklaas J, Kane MP. Thyroid Disorders. **In:** DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: A Pathophysiologic Approach, 10e. . *McGraw-Hill Education* **2016**; United States of American.  
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## Case *Cont'd*

- What is the most appropriate therapy for K.M.?
  - A. MMI
  - B. PTU
  - C. Levothyroxine
  - D. Beta-blocker
  - E. RAI





## Case *Cont'd*

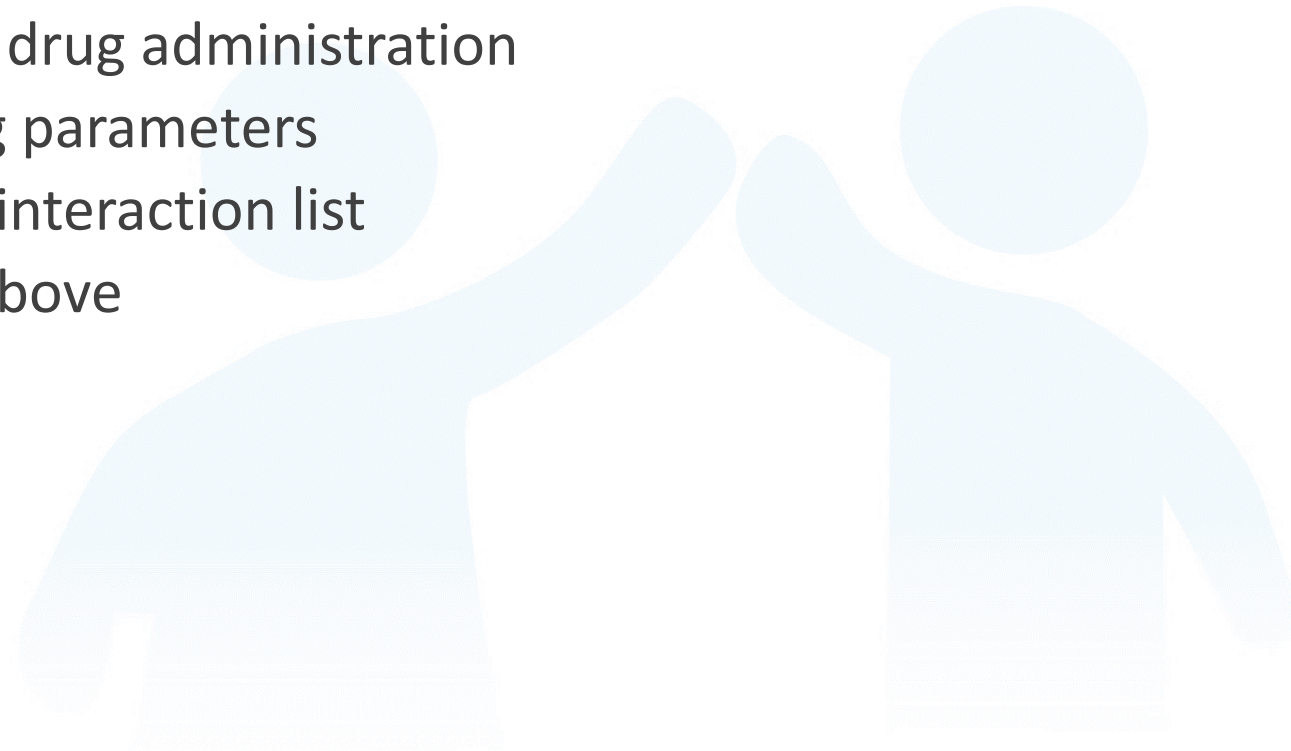
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## Case *Cont'd*

- Which of the following is/are important counseling point(s) to give K.M. regarding her therapy?
  - A. Appropriate dose and dosing frequency of the selected drug
  - B. Method of drug administration
  - C. Monitoring parameters
  - D. Drug-drug interaction list
  - E. All of the above

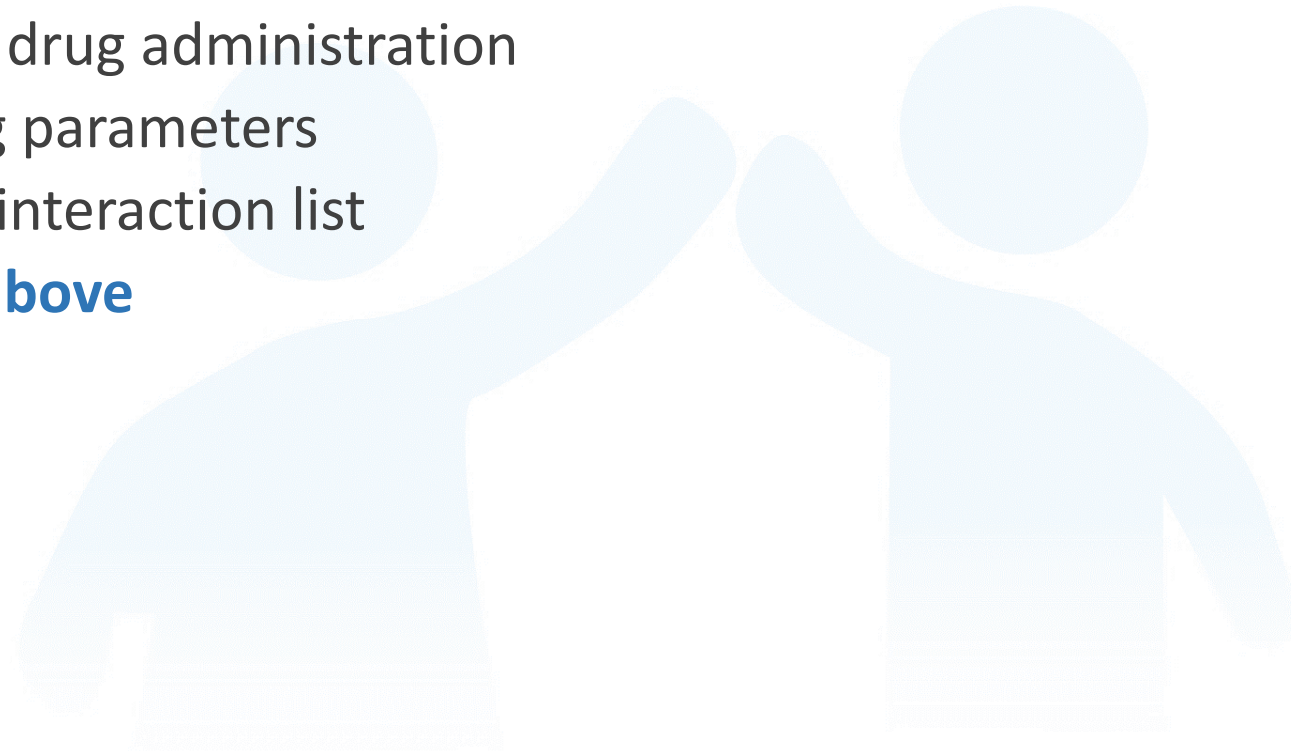






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  - C. Monitoring parameters
  - D. Drug-drug interaction list
  - E. **All of the above**





# Key Takeaways

**Assess your patient's signs and symptoms**  
to confirm a thyroid disorder diagnosis



**Select the most appropriate therapy**



**Counsel your patient regarding**



■ The therapy

■ Disease prognosis

# THANK YOU

