

Total or Complete Thyroidectomy v4.1: Criteria

[Approval & Citation](#)

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Criteria

Inclusion Criteria

- All ENT patients ≥ 3 years of age undergoing total or complete thyroidectomy of any diagnosis

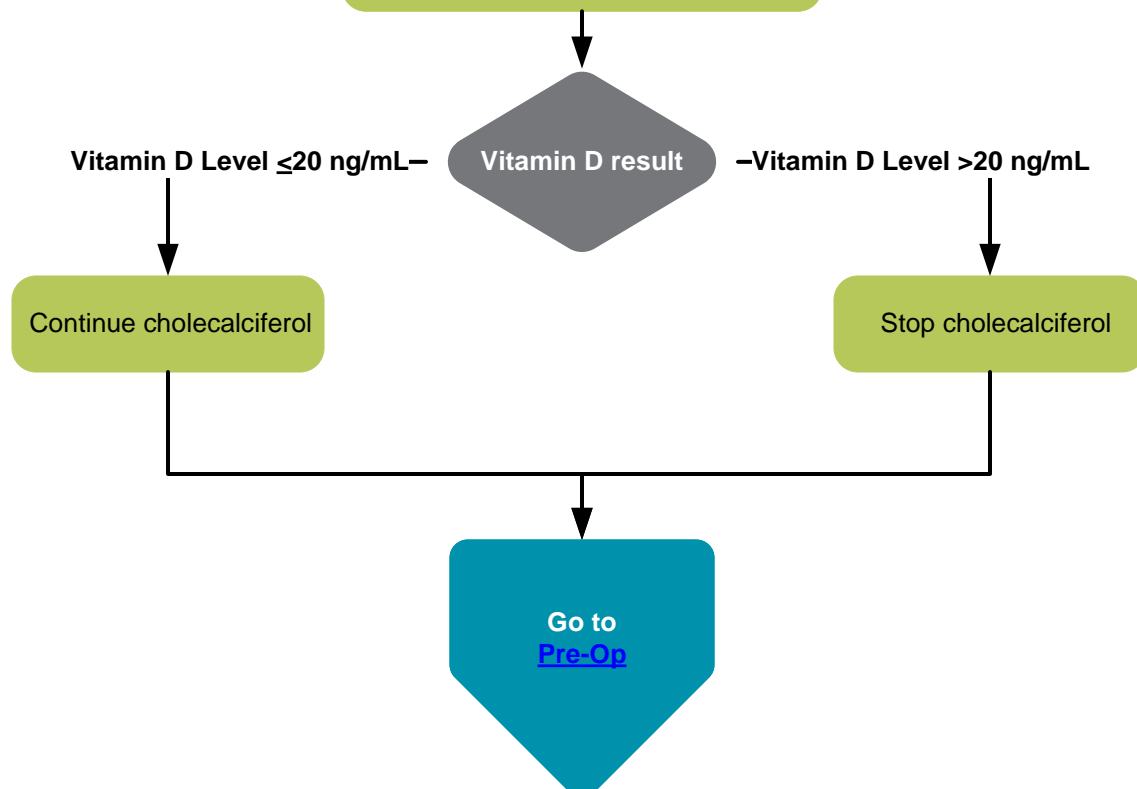
Exclusion Criteria

- Patients < 3 years of age
- Any patients undergoing hemi-thyroidectomy
- Any patients with any of the following:
 1. Chronic renal failure
 2. Known hypo- or hyperparathyroidism
 3. Patients on medications (e.g. diuretics, octreotide, steroids) which may affect calcium or vitamin D metabolism or excretion

Team Notifications PRIOR to Surgery

Email Hospitalist Section with admission information (MRN, date of surgery, planned surgical intervention, co-morbidities)

Check serum total 25-hydroxyvitamin D one month prior to case and start cholecalciferol 50 mcg once a day



Total or Complete Thyroidectomy v4.1: Peri-Operative Phase I Pre-Op

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PHASE I: Pre-Operative

Inclusion Criteria

- All ENT patients ≥ 3 years of age undergoing total or complete thyroidectomy of any diagnosis

Exclusion Criteria

- Patients < 3 years of age
- Any patients undergoing hemi-thyroidectomy
- Any patients with any of the following:
 1. Chronic renal failure
 2. Known hypo- or hyperparathyroidism
 3. Patients on medications (e.g. diuretics, octreotide, steroids) which may affect calcium or vitamin D metabolism or excretion

Corrected total Calcium = Total Calcium +
 $0.8(4 - \text{albumin level})$

Team Notifications on DAY OF Surgery

- Otolaryngology to coordinate PTH processing with laboratory
- Otolaryngology to coordinate with Hospitalist
- Hospitalist to coordinate with Inpatient Endocrinology consult team

Peri-Operative Labs for ALL patients

Total Calcium
Albumin
Magnesium
Phosphorus
Intact PTH
Total 25-OH Vitamin D
Order Intra-Operative PTH
Order Intra-Operative Total Calcium

!

[Ionized Calcium testing](#) is not recommended

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Total or Complete Thyroidectomy v4.1: Peri-Operative Phase II Intra-Op

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PHASE II: Intra-Operative

Inclusion Criteria

- All ENT patients ≥ 3 years of age undergoing total or complete thyroidectomy of any diagnosis

Exclusion Criteria

- Patients < 3 years of age
- Any patients undergoing hemi-thyroidectomy
- Any patients with any of the following:
 1. Chronic renal failure
 2. Known hypo- or hyperparathyroidism
 3. Patients on medications (e.g. diuretics, octreotide, steroids) which may affect calcium or vitamin D metabolism or excretion

Intra-Operative Team Notifications

- OR circulator to coordinate PTH processing with laboratory
- Otolaryngology to coordinate with Hospitalist once case completed

Corrected total Calcium = Total Calcium + $0.8(4 - \text{albumin level})$

- When possible, place two peripheral IV's (PIV) for lab draws
- **Intra-Operative Labs for ALL patients drawn 35 minutes post-thyroidectomy**
- Intact PTH
- Total Calcium

PTH ≤ 16 pg/mL or Graves'
Follow HIGH RISK PHASE

PTH Results

PTH ≥ 17 pg/mL and not Graves'
Follow LOW RISK PHASE

Go to
[Post-Op IIIa](#)

PICU Admit Criteria (any of the following)

- Medically Complex
- Post-extubation stridor (palsy of recurrent laryngeal nerve)
- Pneumothorax
- Intra-operative total Calcium of < 5
- Uncontrolled Graves disease (hypertension, tachycardia, etc.)

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[Post-OP IIIb](#)

Surgical Unit Admit Criteria

- Any patients not meeting PICU criteria

Total or Complete Thyroidectomy v4.1: Post-Operative High Risk Phase IIIa

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PHASE IIIa: Post-Operative High Risk

Inclusion Criteria

- All ENT patients ≥ 3 years of age undergoing total or complete thyroidectomy of any diagnosis

Exclusion Criteria

- Patients < 3 years of age
- Any patients undergoing hemi-thyroidectomy
- Any patients with any of the following:
 - Chronic renal failure
 - Known hypo- or hyperparathyroidism
 - Patients on medications (e.g. diuretics, octreotide, steroids) which may affect calcium or vitamin D metabolism or excretion

All patients:

- Draw ALL labs off second PIV
- Start levothyroxine on POD #1
- Start CR monitoring
- If Magnesium < 1.7 AND persisting hypocalcemia w/ or w/o symptoms then replace with IV magnesium sulfate times three doses (if persisting hypomagnesemia, consider starting oral supplementation in addition to IV dosing)

RRT/Transfer Indications

- Q2-4^o lab checks or physical exam checks
- Asymptomatic hypocalcemia (total Calcium < 7) refractory to 2 consecutive doses of IV calcium gluconate
- Severe hypocalcemia signs/symptoms
- IF TRANSFER TO PICU CONTINUE PROTOCOL UNLESS CLINICAL STATUS PRECLUDES CONTINUATION**

Corrected total Calcium = Total Calcium + $0.8(4 - \text{albumin level})$

35 minute post-thyroidectomy PTH

PTH ≤ 16 pg/mL or Graves'

Hypocalcemia Sign/Symptoms:

Mild: Peri-oral numbness, tingling in the hands/feet, muscle cramps, fatigue.
Severe: Laryngospasm, tetany, seizures
Arrhythmia (prolonged QRS, QT)

Symptomatic Hypocalcemia Treatment

Check total Calcium, Magnesium immediately if symptomatic

MILD SYMPTOMS

- Total Calcium 7-8.5: Consider increasing oral replacement of calcium carbonate, otherwise continue to monitor, consider more frequent total Calcium checks.
- Total Calcium < 7 : Increase calcium carbonate and/or calcitriol AND give IV calcium gluconate and recheck total Calcium 30 minutes after infusion. If recheck is normal, then continue Q6 hour monitoring.

SEVERE SYMPTOMS REGARDLESS OF PTH LEVEL

- Call RRT
- Give IV calcium gluconate
- Recheck total Calcium in 1 hour. If recheck is normal, continue Q6 hour monitoring.

GOAL: START ORAL SUPPLEMENTS < 2 HOURS FROM THYROIDECTOMY

- Start calcium carbonate and calcitriol STAT
- Check total Calcium 3 hours after thyroid removed; if total Calcium > 7 then check total Calcium Q6

Symptomatic hypocalcemia?

YES

NO

Asymptomatic Hypocalcemia Treatment

- If total Calcium 7-8.5: Discuss w/ Endocrinology about increasing calcium carbonate or calcitriol and recheck total Calcium after 2 h. If recheck total Calcium is < 7 , then give IV calcium gluconate AND recheck total calcium 30 minutes after infusion. Consider more frequent total Calcium monitoring.

Discharge Criteria

Patients should meet ALL of the following

- Pain controlled without IV meds > 4 hours
- Total Calcium levels ≥ 8 mg/dL for a minimum of three consecutive checks if: High Risk OR Low Risk AND initial post-operative total Calcium < 8.5
- No active mild symptoms of hypocalcemia (paresthesias, muscle cramping)
- > 24 hours of post-procedure clinical monitoring
- Maintaining hydration orally/enterally
- No signs of active bleeding
- All drains discontinued
- Afebrile ($< 38.5^{\circ}\text{C}$) for greater than 24 hours

Discharge Note

- For ALL patients discharging with calcium supplements

Discharge Instructions

- See post-thyroidectomy order set DC instructions

Total or Complete Thyroidectomy v4.1: Post-Operative Low Risk Phase IIIb

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PHASE IIIb: Post-Operative Low Risk

Inclusion Criteria

- All ENT patients ≥ 3 years of age undergoing total or complete thyroidectomy of any diagnosis

Exclusion Criteria

- Patients < 3 years of age
- Any patients undergoing hemi-thyroidectomy
- Any patients with any of the following:
 - Chronic renal failure
 - Known hypo- or hyperparathyroidism
 - Patients on medications (e.g. diuretics, octreotide, steroids) which may affect calcium or vitamin D metabolism or excretion

All patients:

- Draw ALL labs off second PIV
- Start levothyroxine on POD #1
- Start CR monitoring
- If Magnesium < 1.7 **AND** persisting hypocalcemia w/ or w/o symptoms then replace with IV magnesium sulfate times three doses (if persisting hypomagnesemia, consider starting oral supplementation in addition to IV dosing)

RRT/Transfer Indications

- Q2-4^o lab checks or physical exam checks
- Asymptomatic hypocalcemia (total Calcium < 7) refractory to 2 consecutive doses of IV calcium gluconate
- Severe hypocalcemia signs/symptoms
- IF TRANSFER TO PICU CONTINUE PROTOCOL UNLESS CLINICAL STATUS PRECLUDES CONTINUATION**

Corrected total Calcium = Total Calcium + $0.8(4 - \text{albumin level})$

35 minute post-thyroidectomy PTH

PTH ≥ 17 pg/mL and not Graves'

Hypocalcemia Sign/Symptoms:

Mild: Peri-oral numbness, tingling in the hands/feet, muscle cramps, fatigue.
Severe: Laryngospasm, tetany, seizures Arrhythmia (prolonged QRS, QT)

Symptomatic Hypocalcemia Treatment

Check total Calcium, Magnesium immediately if symptomatic

MILD SYMPTOMS

Start calcium carbonate AND calcitriol. Recheck total Calcium in 3 hours.

SEVERE SYMPTOMS REGARDLESS OF PTH LEVEL

- Call RRT
- Give IV calcium gluconate
- Recheck total Calcium 30 minutes after infusion. If recheck is normal, then continue Q6 hour monitoring.

Check total Calcium 6 hours after thyroid removed

- If total Calcium > 8.5 , then stop checks unless symptomatic.
- If total Calcium ≤ 8.5 , then check total Calcium Q6 hrs.

Symptomatic hypocalcemia?

YES

NO

Asymptomatic Hypocalcemia Treatment

- If total Calcium < 8 : then start calcium carbonate AND calcitriol, recheck total calcium in 3 hours. If recheck is > 7 then continue checking total Calcium Q6 hrs

Discharge Criteria

- Patients should meet ALL of the following
- Pain controlled without IV meds > 4 hours
 - Total Calcium levels ≥ 8 mg/dL for a minimum of three consecutive checks if: High Risk OR Low Risk AND initial post-operative total Calcium < 8.5
 - No active mild symptoms of hypocalcemia (paresthesias, muscle cramping)
 - > 24 hours of post-procedure clinical monitoring
 - Maintaining hydration orally/enterally
 - No signs of active bleeding
 - All drains discontinued
 - Afebrile ($< 38.5^{\circ}\text{C}$) for greater than 24 hours

Discharge Note

- For ALL patients discharging with calcium supplements

Discharge Instructions

- See post-thyroidectomy order set DC instructions

Introduction to Post-Thyroidectomy Pathway

Goals of Post-Thyroidectomy Pathway

- Standardization of post-thyroidectomy care for all patients
 - Decrease risk of post-operative hypocalcemia
 - Decrease length of stay
 - Decrease variability of blood draws
 - Improve cost
 - Improve patient/family satisfaction

Pathway Inclusion/Exclusion Criteria

Inclusion Criteria

All ENT patients undergoing total or completion thyroidectomy regardless of age or diagnosis

Exclusion Criteria

- Any patients undergoing hemi-thyroidectomy
- Any patients with any of the following:
 1. Chronic renal failure
 2. Known hypo- or hyperparathyroidism
 3. Patients on medications (e.g. diuretics, octreotide, steroids) which may affect calcium or vitamin D metabolism or excretion

- Patients who meet these criteria should be placed on the total or completion thyroidectomy pathway via use of the thyroidectomy orderset

NOTE: If concerns about further inclusion/exclusion criteria, discuss with primary team and Endocrinology

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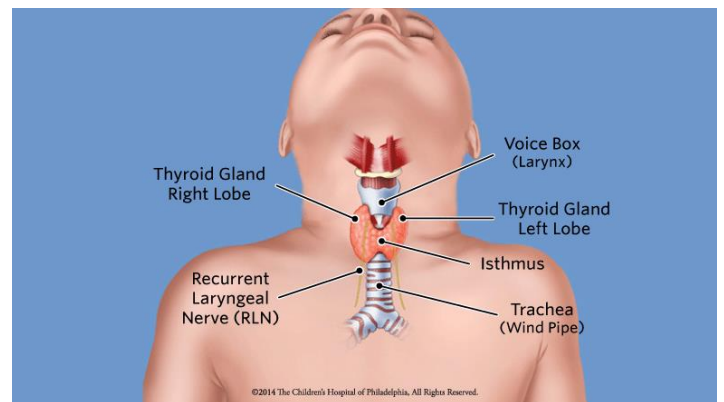
Thyroidectomy At a Glance

Indications for total thyroidectomy

- Goiter
- Hyperthyroidism
- Thyroid neoplasia
 - MEN
 - Papillary carcinoma
 - PTEN syndrome
- Thyroid nodules

Potential surgical complications of thyroidectomy

- Hematoma (<3%)
 - Potential for airway compromise due to compression
- Transient hypocalcemia (7-52%)
 - **Most common**
 - Temporary “stunning” of glands (most common)
 - Devascularization of glands
 - Complete excision of glands
- Permanent hypocalcemia (<8%)
 - Requires all four parathyroid glands to be non-functional
- Recurrent laryngeal nerve injury (<1%)
 - Unilateral vs Bilateral vocal fold immobility
 - Bilateral can cause severe airway obstruction sometimes requiring tracheotomy

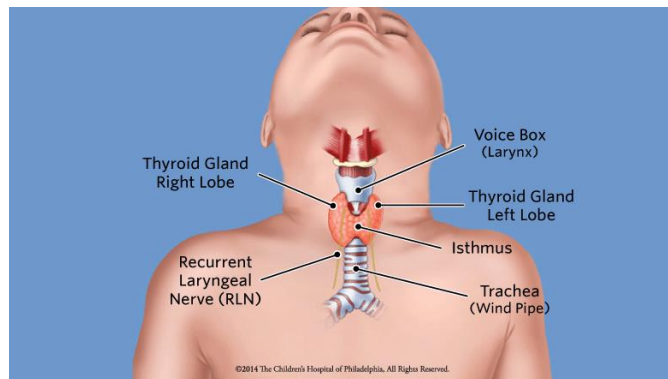


Bailey's Head and Neck Surgery. 5th Ed
Image Source: <http://www.chop.edu/conditions-diseases/differentiated-thyroid-cancer/>

Thyroidectomy At a Glance

Rare surgical complications of thyroidectomy

- Chyle leak
 - Thoracic Duct Injury
- Esophageal perforation
- Pneumomediastinum
- Tracheal perforation



Bailey's Head and Neck Surgery. 5th Ed

Image Source: <http://www.chop.edu/conditions-diseases/differentiated-thyroid-cancer/>

Admission Criteria

All patients will be admitted to Surgical Floor unless meeting the following ICU criteria:

- PICU Admit Criteria (any of the following)
 - Medically Complex
 - Post-extubation stridor (recurrent laryngeal nerve palsy)
 - Pneumothorax
 - Intra-operative total calcium of <5
 - Uncontrolled Graves (hypertension, tachycardia, etc)

NOTE: PICU admit criteria are not an absolute, if concerns discuss with ICU prior to transfer from OR/PACU.

Post-Thyroidectomy Hypocalcemia

Goals of Post-Thyroidectomy Pathway

- Primary goal of post-thyroidectomy care for all patients is to decrease risk of post-operative hypocalcemia
 - Secondary to transient or permanent hypoparathyroidism
 - Transient: incidence between 7-52% for total thyroidectomy
 - Permanent: incidence between 0%-8% for total thyroidectomy
- The following slides will review common physical exam findings and pathway laboratory monitoring plan for post-thyroidectomy patients

Post-Thyroidectomy Hypocalcemia

Physical Exam

Varies depending on degree of patient's hypocalcemia

- Mild/Moderate symptoms
 - Fatigue
 - Muscle cramping or spasms
 - Paresthesias: perioral, hands, or feet

NOTE: Biochemical confirmation (serum total calcium) should be checked immediately if any concerning signs or symptoms

Physical Exam

Varies depending on degree of patient's hypocalcemia

- Severe symptoms
 - Arrhythmias
 - Prolonged QRS, QT
 - Laryngospasm
 - Seizure
 - Tetany

NOTE: If severe signs/symptoms of hypocalcemia, then immediate ICU evaluation is required

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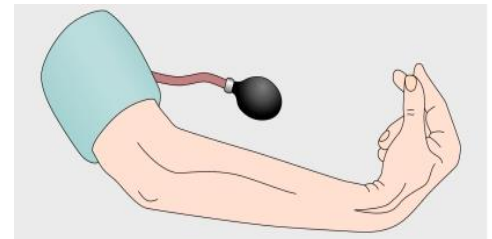
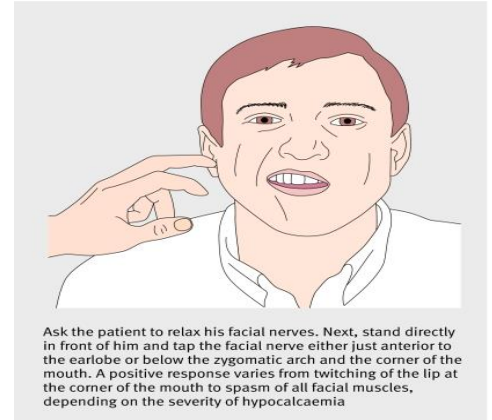
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Post-Thyroidectomy Hypocalcemia

Physical Exam

- Exam findings such as Chvostek's or Trousseau's signs should be considered relatively unreliable at diagnosing hypocalcemia in patients
 - Chvostek's Sign (see image to right)
 - Up to 10 % of eucalcemic patients can have a positive Chvostek's sign
 - Trousseau's Sign (see image to right; carpopedal spasm with inflation of blood pressure cuff)
 - Relatively specific for hypocalcemia with up to 94% of patients will have a positive Trousseau's sign



NOTE: Biochemical confirmation (serum total calcium) should be checked immediately if any concerning examination findings

Cooper, 2008
Image Source: Cooper, 2008

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Post-Thyroidectomy Hypocalcemia

Which post-thyroidectomy patients are at higher risk for post-operative hypocalcemia and should be started on calcium supplements?

- Limited data are available for pediatric patients; however, intact parathyroid hormone levels provided indication of risk of post-operative biochemical or symptomatic hypocalcemia (Freire 2014)
- *Patients with post-operative PTH level of less than or equal to 16 pg/mL OR Graves' Disease are at higher risk for hypocalcemia and should be started on oral calcium replacement (★○○○ Very Low quality- Freire 2014)*

NOTE: Although low post-operative PTH indicated higher risk of hypocalcemia; **ALL** patients should be monitored closely for hypocalcemia symptoms

Post-Thyroidectomy Hypocalcemia

At what time should an intact PTH level be checked post-thyroidectomy?

- Single pediatric study checked post-operative intact PTH levels at 5 minutes and 1 hour after thyroid was removed with similar sensitivity, specificity, and positive predictive value (Freire 2014).
- *Check intact PTH level 35 minutes (approximately seven half lives) after thyroid has been removed (LOE: Expert opinion)*

NOTE: Although low post-operative PTH indicated higher risk of hypocalcemia; **ALL** patients should be monitored closely for hypocalcemia symptoms

Post-Operative Hypocalcemia Monitoring

Is total calcium or ionized calcium better for post-thyroidectomy hypocalcemia monitoring?

- No current studies available to show clinical value of ionized calcium over total calcium for routine calcium level monitoring post-thyroidectomy
- Although ionized calcium is biologically active form of calcium, method of collection (syringe on ice), stability of sample, and cost make routine use prohibitive
- *Total calcium should be monitored in all patients including those patients with hypoalbuminemia (albumin <3.5). Corrected total calcium should be used in hypoalbuminemic patients (LOE: Expert opinion)*

NOTE: Ionized calcium should NOT be used in addition to total calcium

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Post-Operative Hypocalcemia Monitoring

How frequent should total calcium be monitored post-operatively?

- There are no current standards to guide frequency or timing of routine calcium checks in the immediate post-operative period. Also, no standards exist for those patients receiving oral or intravenous calcium.
- *Monitor total calcium at least every six hours for all patients. If high risk for hypocalcemia (35 minute post-operative PTH <16 pg/mL OR Graves' Disease) then check level no later than three hours after thyroid removed. (LOE: Expert opinion).*
- *If mild or severe hypocalcemia symptoms then check total calcium immediately. Also, check total calcium no later than one hour after intravenous calcium gluconate infusion complete (LOE: Expert opinion).*

NOTE: Patients with biochemical, symptomatic hypocalcemia, or patients needing changes in supplements, may necessitate more frequent total calcium monitoring.

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Post-Operative Hypocalcemia Prevention

When indicated, when should calcium supplement be started?

- Higher risk patients (iPTH \leq 16 pg/dL) require supplementation which includes activated vitamin D (calcitriol) and calcium
- Goal is to prevent biochemical AND symptomatic hypocalcemia in immediate post-operative period when transient hypoparathyroidism is most common
- *Immediate (less than two hours) post-operative oral supplementation of calcium carbonate AND calcitriol (active vitamin D for absorption of calcium from intestines and kidneys) for high risk patients. (LOE: Expert opinion).*

NOTE: Early administration is best! If oral route is not an option (e.g., post-operative nausea, vomiting, stridor, etc.) give calcium intravenously

Post-Operative Hypocalcemia Treatment

Which calcium therapy (IV vs PO) is indicated for asymptomatic (biochemical) vs symptomatic hypocalcemia?

- Although intravenous calcium has risks, certain patients should be corrected via IV route to decrease risk of hypocalcemia sequelae.
- *Persisting asymptomatic (biochemical) hypocalcemia, hypocalcemia of less than <math><7.0</math>, or severe symptoms should be treated with IV calcium gluconate despite risks of IV calcium gluconate. (LOE: Expert opinion).*

NOTE: Any patient receiving IV calcium gluconate should be monitored on CR monitoring

Which calcium therapy (IV vs PO) is indicated for asymptomatic (biochemical) vs symptomatic hypocalcemia?

- There is no specific literature which addresses this question however IV calcium gluconate should be used with caution given the risk of soft tissue injury with extravasation, arrhythmia, vasodilation, etc.
- Given lack of literature, discussion with Endocrinology may be necessary, especially for those patients that may be at maximum dose of oral supplements
- *Asymptomatic (biochemical) hypocalcemia may be treated with addition of or increase in oral calcium carbonate and/or calcitriol supplementation. (LOE: Expert opinion).*

NOTE: Early administration is best! If oral route is not an option (e.g. post-operative nausea, vomiting, stridor, etc) consider giving calcium intravenously

Post-Operative Hypocalcemia Monitoring

How frequent should labs (total calcium, phosphorus, magnesium, albumin) be monitored?

- Electrolytes which may affect serum calcium levels (primarily phosphorus, magnesium, and albumin) may be checked prior to surgery (pre-operatively) but there is no current evidence that suggests need for scheduled post-operative monitoring.
- Magnesium is needed for release of parathyroid hormone from parathyroid glands; however, 11-33% of healthy patients may have hypomagnesemia (Schimatschek 2001)
- *Check phosphorus, magnesium, albumin, only pre-operatively. May consider rechecking magnesium and phosphorus if persisting biochemical hypocalcemia (LOE: Expert opinion).*

NOTE: Hypomagnesemia (Mg <1.7) AND persisting hypocalcemia should be treated with standard three doses of IV magnesium sulfate.

Post-Operative Hypocalcemia Escalation of Care

Although the goal should be routine care on surgical floors; post-thyroidectomy patients may need to be transferred to PICU for:

- Increased frequency of lab checks or physical exam monitoring
- Asymptomatic hypocalcemia (total Ca^{2+} <7.0) refractory to 2 consecutive doses of IV calcium gluconate
- Severe hypocalcemia signs/symptoms
- ***This list should not be considered comprehensive for all possible ICU transfer indications. If medical or surgical concerns then RRT should be called to help determine further clinical management.

NOTE: If patient is transferred to PICU, protocol should be adhered to unless patient's clinical status indicates deviation from protocol

Discharge Criteria

Discharge Criteria

Patients should meet ALL of the following

- Pain controlled without IV meds >4 hours
- Total Calcium levels > 8.0 mg/dL for a minimum of three consecutive checks if: High Risk OR Low Risk AND initial post-operative total Calcium <8.5
- No active mild symptoms of hypocalcemia (paresthesias, muscle cramping)
- > 24 hours of post-procedure clinical monitoring
- Maintaining hydration orally/enterally
- No signs of active bleeding
- All drains discontinued
- Afebrile (<38.5°C) for greater than 24 hours

- ***On rare occasions, patients may be discharged home with total calcium levels ≤ 8.0 mg/dL after greater than 24 hours of monitoring MUST meet the following:
 - Total calcium levels are not decreasing
 - Patient's calcium replacement is maximized
 - Laboratory follow up plan is made with Endocrinology
 - Patient is asymptomatic and family shows understanding of hypocalcemia symptoms which should prompt immediate medical evaluation

Discharge Instructions

- Child may return to school in 7 days. No physical exercise or physical activity for 14 days from surgery. Excuse parent or caregiver from work for 7-14 days.
- Monitor your child for any tingling in hands, feet, or around his/her mouth; muscle cramping or spasms; as these may be signs of hypocalcemia. If your child is discharged with oral calcium (Tums) then give one dose and call on-call Endocrinology.
- Wound care instructions: Keep wound dry for 48 hours. Do NOT remove steri-strips, they will fall off on their own. If redness or drainage or other new symptom, please call on-call ENT provider.
- Follow up appointments with Endocrinology, Oncology (if indicated), Otolaryngology, will vary depending on patient's clinical diagnosis and status at time of discharge.

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Discharge Instructions Continued

- *Monitor your child for any abdominal pain, constipation, muscle weakness, lethargy, nausea, or confusion; as these may be signs of high calcium. If there are questions, please call on-call Endocrinology provider.*

*****Discharge NOTE: If a patient is being discharged on ANY calcium or magnesium supplements, regardless of level of risk for hypocalcemia, the patient MUST have labs drawn within 3-4 days after discharge. Please have these patients follow up with their pediatrician in this timeframe to ensure labs are drawn.*****

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Thyroidectomy Approval & Citation

Approved by the CSW Thyroidectomy pathway team for December 11, 2017 go-live date.

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CIS Analyst:	Maria Jerome
Librarian:	Sue Groshong
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Retrieval Website: <https://www.seattlechildrens.org/pdf/Thyroidectomy-pathway.pdf>

Please cite as:

Seattle Children's Hospital, Adams, S., Deam N., DiVall, S., Foti, J., Hoffer, D., Leu, M., Lorenzo, K., Roth, C., Valdivia, H., 2017 December. Thyroidectomy Pathway. Available from: <https://www.seattlechildrens.org/pdf/Thyroidectomy-pathway.pdf>

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Evidence Ratings

This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children's. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94.):

Quality ratings are *downgraded* if studies:

- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise OR
- If it is felt that there is substantial publication bias

Quality ratings are *upgraded* if it is felt that:

- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
- If a dose-response gradient is evident

Guideline – Recommendation is from a published guideline that used methodology deemed acceptable by the team.

Expert Opinion – Our expert opinion is based on available evidence that does not meet GRADE criteria (for example, case-control studies).

Quality of Evidence:

★★★★ High quality

★★★○ Moderate quality

★★○○ Low quality

★○○○ Very low quality

Guideline

Expert Opinion

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Summary of Version Changes

- **Version 1.0 (12/11/2017):** Go live.
- **Version 2.0 (10/10/2018):** Changed name of lab test Intraoperative PTH to Intraoperative PTH, Intact per lab request; added Discharge Communication for Otolaryngology RN to call for routine status update; added Discharge Instructions to monitor child for signs/symptoms of hypercalcemia; added Discharge NOTE with instructions to make PCP appointment for patients discharged with calcium supplements.
- **Version 3.0 (3/7/2022):** Updated cholecalciferol dose units from International Units (IU) to micrograms (mcg).
- **Version 3.1 (5/19/2022):** No content changes. Medication dosages reviewed and approved by Pharmacy and Therapeutics Committee on 2/15/2022.
- **Version 4.0 (4/18/2023):** Post-Operative High Risk Phase IIIa, Post-Operative Hypocalcemia Prevention training slide, and Post-Operative Hypocalcemia Treatment training slide updated to align with SCH formulary changes.
- **Version 4.1 (5/17/2023):** No content changes. Medication dosing recommendations reviewed and approved by Pharmacy and Therapeutics Committee on 5/16/2023.

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Medical Disclaimer

Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children's Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

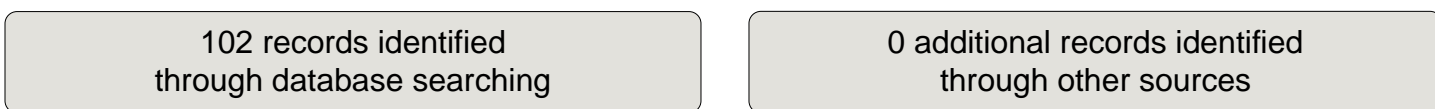
Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.

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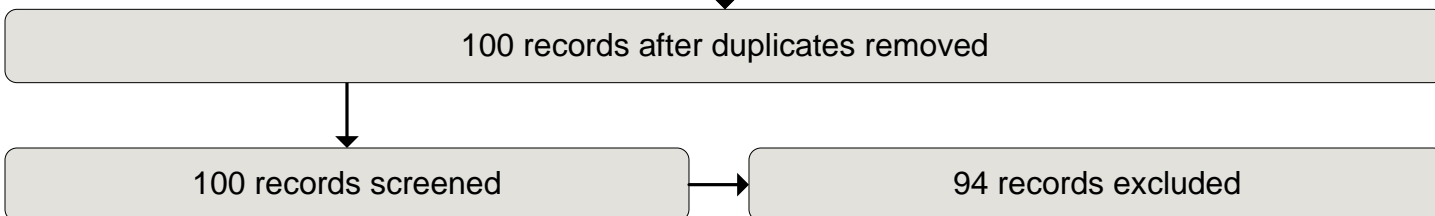
Bibliography

Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian, Susan Klawansky. Searches were performed in October 2015. The following databases were searched – on the Ovid platform (all 2005 to date): Medline, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials; elsewhere – Embase (2005 to date), Clinical Evidence, National Guideline Clearinghouse and TRIP (2005 to date). Retrieval was limited to 0-18 years of age and English language. In Medline and Embase, appropriate Medical Subject Headings (MeSH) and Emtree headings were used respectively, along with text words, and the search strategy was adapted for other databases. Concepts searched were thyroidectomy or thyroid disease and any of the following: hypocalcemia, hypoparathyroidism, parathyroid hormone, calcium, phosphates, calcium phosphates, magnesium or magnesium deficiency. All retrieval was further limited to certain evidence categories, such as relevant publication types, Clinical Queries, index terms for study types and other similar limits.

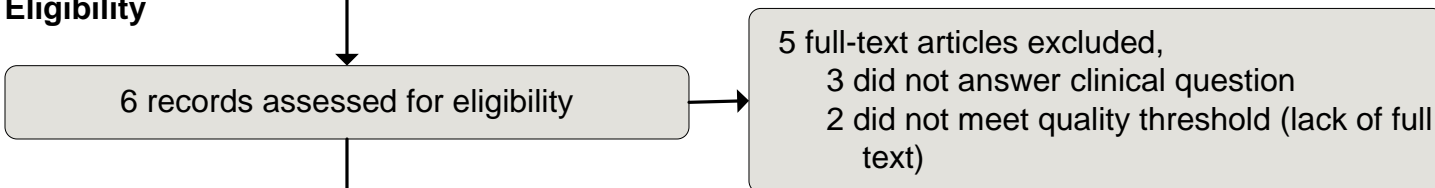
Identification



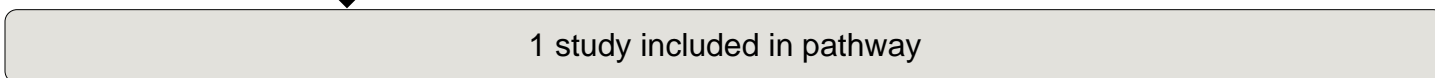
Screening



Eligibility



Included



Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535

Bibliography

Freire AV, Ropelato MG, et al. Predicting hypocalcemia after thyroidectomy in children. *Surgery*. 2014; 156; 130-136.

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