CLINICAL PATHWAY:

Peri-Operative Thyroidectomy Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Inclusion Criteria: Patients having a total thyroidectomy OR partial thyroidectomy with post-op PTH ≤ 20 pg/mL
Exclusion Criteria: Patients not having a thyroidectomy

Within 3 Months Prior to Surgery

- Surgery or Endocrinology team to order labs: Intact PTH with ionized calcium (ical), total calcium, albumin, 25-OH vitamin D, phosphorus, magnesium
- Surgery or Endocrinology team to start vitamin D based on serum 25-OH vitamin D level:
  - < 10 ng/mL: Contact on-call endocrinologist for recommendations
  - 11-20 ng/ml: give one time dose of vitamin D2 50,000 IU orally, then maintenance of vitamin D3 2,000 IU daily
  - 21- 30 ng/mL: give maintenance dose of vitamin D3 2,000 IU daily
    *note: vitamin D is fat-soluble and should be given with a meal to maximize absorption
- Surgery team (OR scheduler) to contact Endocrine nurses through Epic in-basket (p_endo_results_triage) with patient name and date of surgery

Thyroidectomy performed at Connecticut Children's

Immediate post-op in PACU

- Surgery team to order STAT intact PTH with ical 20-60 minutes after surgery with note in specimen bag stating "From Connecticut Children's OR"
- Obtain total calcium, albumin, 25-OH vitamin D, phosphorus, and magnesium
- Please call on call Endocrinologist to determine immediate calcium and/or calcitriol supplementation based on periop PTH levels and risk of hypocalcemia (see below)
- Post-operative monitoring:
  - Total calcium, ical and phosphorus levels q6hr, or more frequently as clinically indicated
  - Monitor for signs or symptoms or hypocalcemia (Appendix A)

Ongoing Care

- When ready, admit to MS floor on Pediatric Surgery team with consult for Endocrinology co-management
- Continue to follow treatment and monitoring algorithm below based upon perioperative PTH levels and risk of hypocalcemia (if result not interpretable resend STAT)

Intact PTH <10 ng/mL

High risk of hypocalcemia

Treatment:

- IV calcitriol x 1 dose STAT in PACU (see Appendix B for dosing)
- Start PO calcitriol and calcium carbonate as soon as able to tolerate PO (see Appendix B for prescribing), with goal to start within 6hr of surgery
- Consider IV calcitriol and IV calcium gluconate if unable to tolerate PO, or if symptomatic hypocalcemia (see Appendix B for prescribing). If only minor symptoms, can consider PO calcium (see Appendix A for definition of minor symptoms)
- Vitamin D2 and/or D3 as clinically indicated
- Magnesium oxide as clinically indicated

Monitoring

- Total calcium, ical and phosphorus q6hr, or more frequently as clinically indicated (1-2 hours after IV calcium gluconate for symptomatic hypocalcemia)
- Consider obtaining PTH with ical if low total calcium level (see Appendix C for normal lab values by age) or if symptomatic hypocalcemia (Appendix A)
- Call Endocrinology to discuss increase in PO calcium and/or calcitriol if no improvement in total calcium

Intact PTH 10-20 ng/mL

Intermediate risk of hypocalcemia

Treatment:

- Calcium carbonate as soon as able to tolerate PO (see Appendix B for dosing), with goal to start within 6hr of surgery
- Consider IV calcium gluconate if unable to tolerate PO (see Appendix B for prescribing)
- Vitamin D2 and/or D3 as clinically indicated
- Magnesium oxide as clinically indicated

Monitoring:

- Total calcium, ical and phosphorus q6hr, or more frequently as clinically indicated
- Consider obtaining PTH with ical if low total calcium level (Appendix C) or if symptomatic hypocalcemia (Appendix A)
- Call Endocrinology to discuss increase in calcium and consider starting calcitriol if no improvement in serum calcium (Appendix B)

Intact PTH >20 ng/mL

Low risk of hypocalcemia

Treatment:

- Calcium treatment is not needed if calcium and phosphorus levels are normal (Appendix C)
- Vitamin D2 and/or D3 as clinically indicated
- Magnesium oxide as clinically indicated

Monitoring:

- Total calcium, ical and phosphorus q6hr, or more frequently as clinically indicated.
- If total calcium is > 8.0 x 2, consider discontinuing monitoring
- Consider obtaining PTH with ical if low total calcium level (Appendix C) or if symptomatic hypocalcemia (Appendix A)
- Consider starting calcium and/or calcitriol if no improvement in serum calcium (Appendix B)

Discharge Criteria:

- Serum total calcium ≥ 8.0 ng/dL (high risk patients should have at least 2 values, at least 6 hours apart)
- No IV calcium required within the last 24 hours
- Clearance by Pediatric Surgery team

Discharge Medications, Laboratory Monitoring, and Instructions:

- If total thyroidectomy, start levothyroxine; dosing per Endocrinology
- PTH <10 ng/mL and/or hypocalcemia:
  - Calcitriol and calcium PO; dosing per Endocrinology
  - Serum total calcium in 1-3 days, then calcium and phosphorus levels q3-7 days until they remain normal while weaning calcitriol & calcium
- PTH 10-20 ng/mL:
  - Consider calcium PO (Appendix B). May give a wean schedule (per Endocrinology)
  - Serum total calcium and phosphorus levels in 5-7 days
- PTH >20 ng/mL:
  - Calcium PO not needed
  - Consider total calcium and phosphorus levels within 5-7 days
- Additional labs and medications:
  - TSH, Free T4, and follow up per Endocrinology, usually in 4 weeks
  - Consider a PTH with ical if total calcium <8 mg/dL during weaning of calcitriol and calcium PO
  - Vitamin D2 and/or D3 supplementation
  - Magnesium oxide as clinically indicated

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**All signs and symptoms noted are major unless otherwise noted as minor in parentheses*

Symptoms of hypocalcemia

- Perioral and extremity numbness and/or tingling (minor)
- Muscular cramping
- Fatigue
- Anxiety and depression

Signs of hypocalcemia

- Signs of neuromuscular irritability:
  - Paresthesias (minor)
  - Facial twitching
  - Muscle spasm
  - Laryngospasm
  - Stridor
  - Seizures
  - Tetany
- Chvostek sign (twitching of the circumoral muscles when tapping lightly over the seventh cranial nerve - note that a positive Chvostek sign is found in many normal adolescents) (minor)
- Trousseau sign (carpopedal spasm when maintaining the blood pressure cuff 20 mmHg above the systolic blood pressure
  for 3 minutes)
- Papilledema
- Prolonged QT interval on EKG

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Calcitriol

- General Drug Information:
  - Calcitriol reaches its peak effectiveness at 48-72 hours
- Inpatient Dosing (PO):
  - < 1 year old: 0.04-0.08 mcg/kg/day PO divided q12hr
  - 1-5 yrs or <20 kg: 0.25 – 0.5 mcg per dose PO q12hr
  - > 6 yrs or ≥20 kg: 0.5 – 1 mcg per dose PO q12hr
  - May give up to 1 mcg q8hr if calcium persistently low
- Inpatient Dosing (IV):
  - < 5 yrs: 0.25 mcg x 1 dose
  - 5-10 yrs: 0.5 mcg x 1 dose
  - > 10 yrs: 1-2 mcg x 1 dose
- Discharge Dosing (PO):
  - < 1 year old: 0.04 -0.08 mcg/kg/dose PO once daily
  - 1-5 yrs or <20 kg: 0.25 – 0.75 mcg per dose PO once daily
  - > 6 yrs or ≥20 kg: 0.5 – 2 mcg per dose PO once daily

Calcium Carbonate

- General Drug Information:
  - Begin at lower end of dose range for asymptomatic patients
  - Calcium is given with meals to block phosphorus absorption. Phosphorus starts rising by day 2 on patients with transient/permanent hypoparathyroidism. May need to reduce milk consumption because high in phosphorus.
- Dosing expressed in elemental calcium: (Divide by 0.4 to convert to mg of salt)
  - < 30 kg: 300 - 400 mg Elemental Ca per dose PO q8hr
  - ≥ 30-50 kg: 400-500 Elemental Ca per dose PO q8hr
  - > 50 kg: 500-600 Elemental Ca per dose PO q8hr

Calcium Gluconate

- Dosing based on indication:
  - Symptomatic hypocalcemia
    - 100 mg/kg IV (max 2 grams/dose) infusion over 30 minutes
    - Place on cardiac monitoring, if bradycardic, stop calcium infusion
    - May repeat x1 if symptoms persist
  - Asymptomatic hypocalcemia, unable to tolerate PO
    - 50 mg/kg IV (max 1 gram/dose) infusion over 4 hours
    - IV rate adjusted to keep serum calcium concentration at the lower end of normal range
- Transitioning from IV to PO calcium:
  - Give first oral dose of calcitriol and calcium during IV calcium infusion, as soon as tolerating PO
  - Wean IV dose by 50% increments every 4 hours as long as serum Ca remains >8 mg/dL
  - If Ca <8 mg/dL, resume prior IV Ca rate
  - If patient requires IV calcium >24 hours, consider increasing calcitriol dose

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Total Calcium

Age	Conventional (mg/dL)	SI (mmol/L)
Preterm	6.2-11.0	1.6-2.8
Full term <10 days	7.6-10.4	1.9-2.6
10 days-24 months	9.0-11.0	2.3-2.8
2-12 years	8.8-10.8	2.2-2.7
Adult	8.6-10.0	2.2-2.5

Ionized Calcium

Age	Conventional (mg/dL)	SI (mmol/L)
Newborn <36 hours	4.20-5.48	1.05-1.37
Newborn 36-84 hours	4.4-5.56	1.10-1.42
1-18 years	4.80-5.52	1.20-1.38
Adult	4.64-5.28	1.16-1.32

Phosphorus

Age	Conventional (mg/dL)	SI (mmol/L)
Newborn	4.5-9.0	1.45-2.91
10 days-24 months	4.5-6.7	1.45-2.16
24 months-12 years	4.5-5.5	1.45-1.78
>12 years	2.7-4.5	0.87-1.45

Magnesium

Age	Conventional (mg/dL)	SI (mmol/L)
Child-20 years	1.4-2.5	
Adult	1.5-2.3; 1.3-2.1	0.65-1.05

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