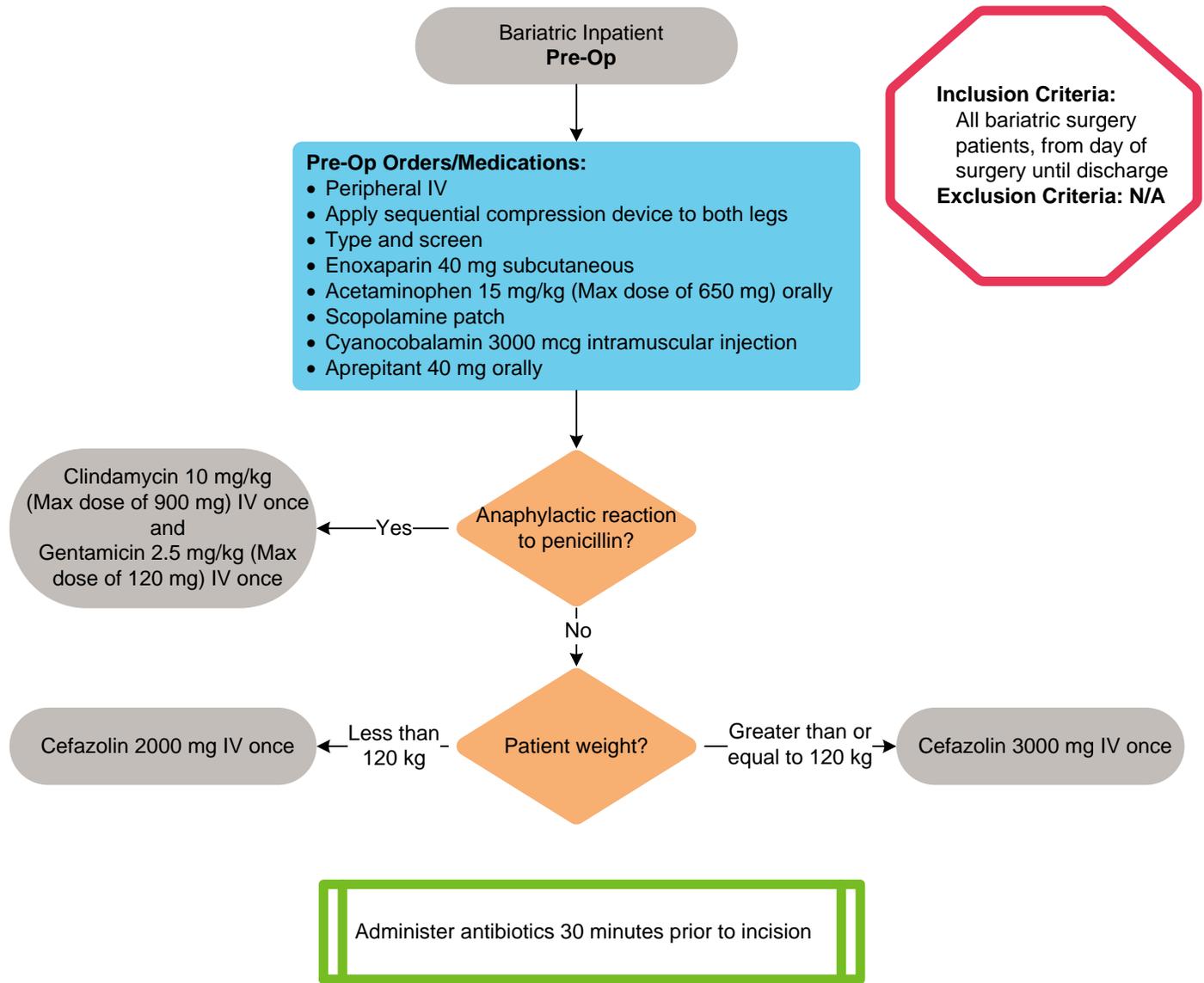


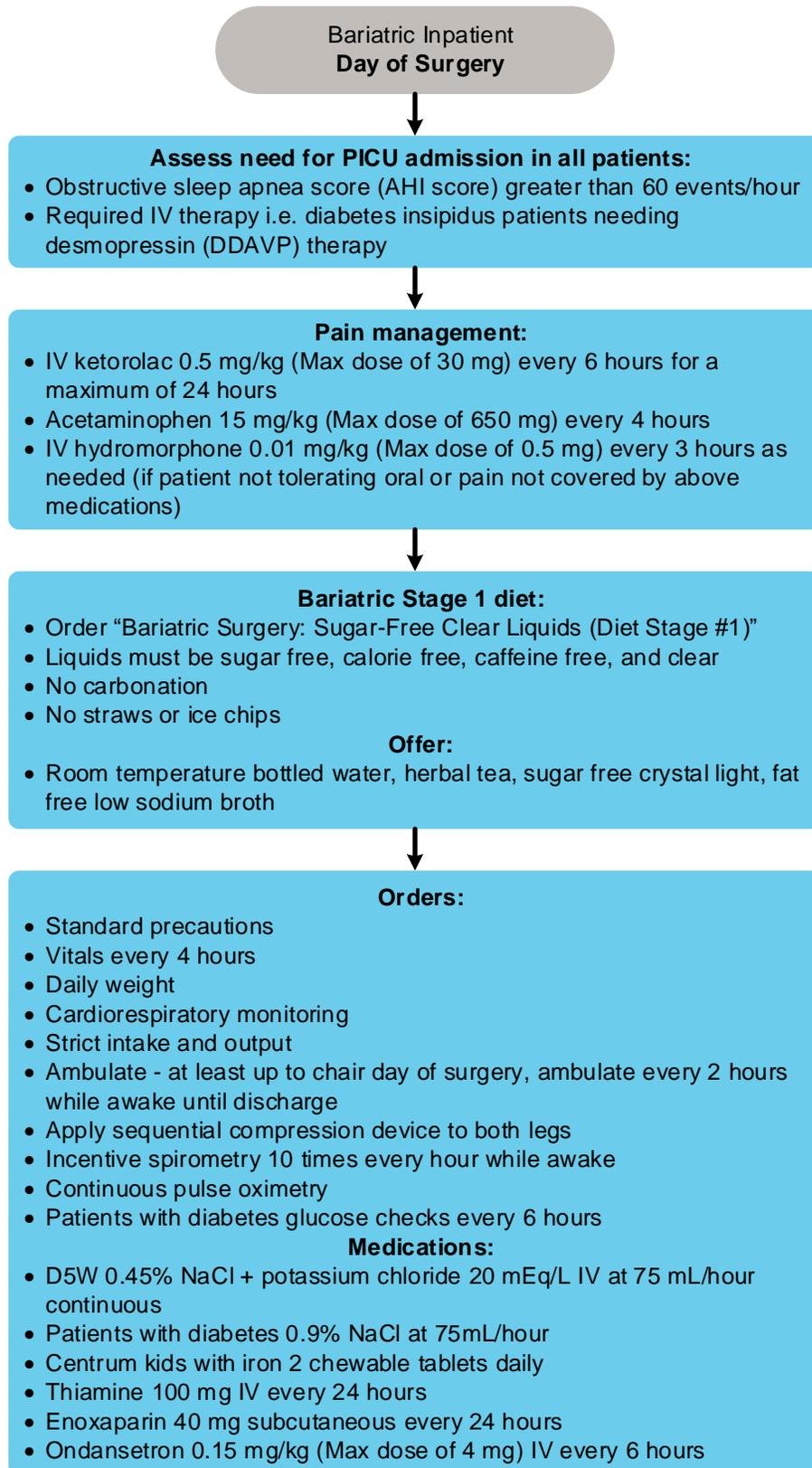
BARIATRIC SURGERY

ENHANCED RECOVERY AFTER SURGERY (ERAS) INPATIENT CARE OF THE BARIATRIC SURGERY PATIENT

ALGORITHM 1. PRE-OP



ALGORITHM 2. DAY OF SURGERY



ALGORITHM 3. POST-OP DAY 1 UNTIL DISCHARGE

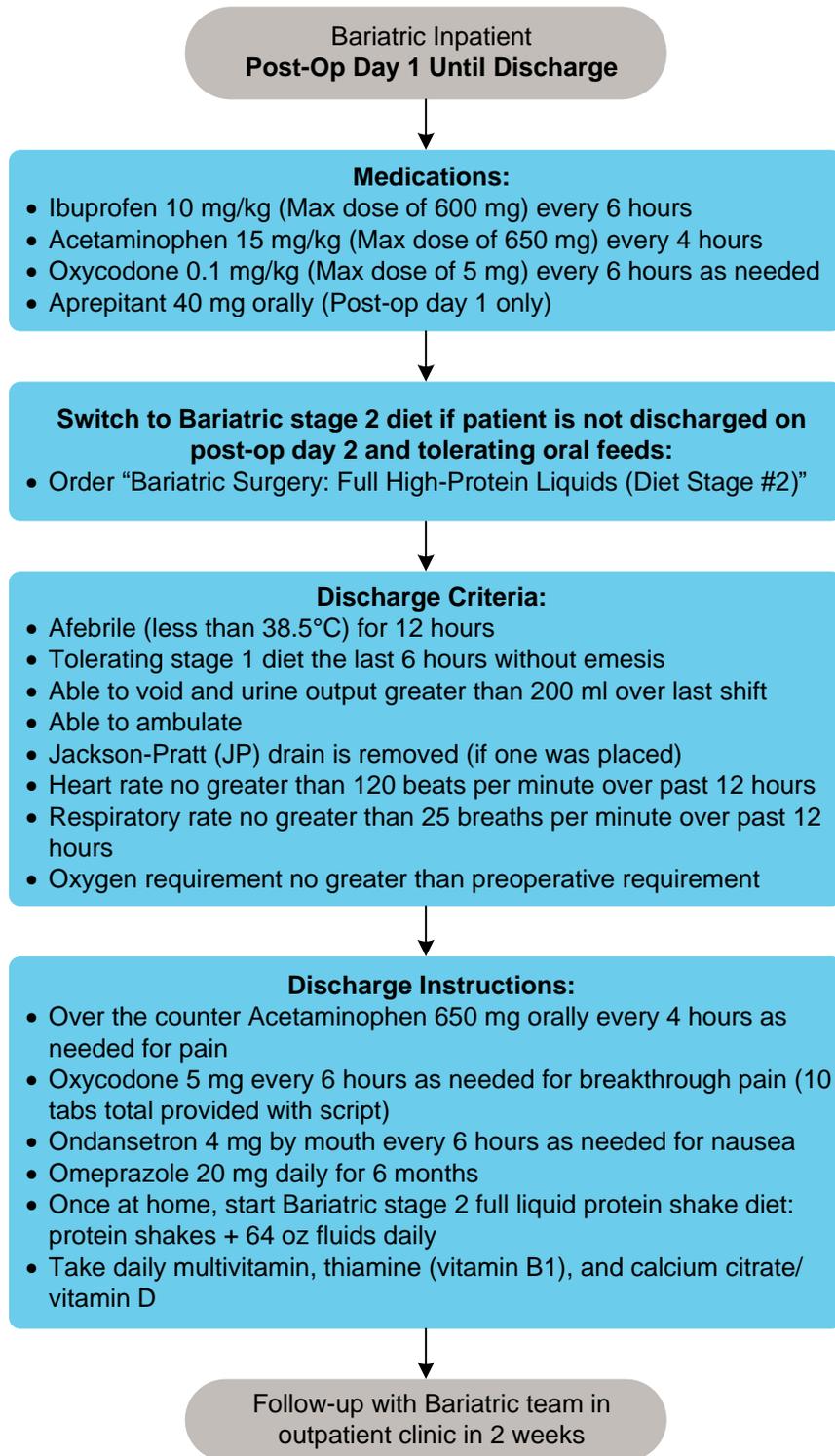


TABLE OF CONTENTS

- [Algorithm 1. Pre-Op](#)
- [Algorithm 2. Day of Surgery](#)
- [Algorithm 3. Post-Op Day 1 Until Discharge](#)
- [Target Population](#)
- [Background on Bariatric Surgery](#)
 - [Types of Surgery Offered](#)
 - [Criteria for Surgery](#)
- [Initial Evaluation: Associated Comorbidities](#)
- [Outpatient Clinical Management](#)
- [Anesthesia and Respiratory Considerations](#)
- [Thrombosis Considerations](#)
- [Therapeutics](#)
- [Laboratory Studies | Imaging](#)
- [Dietary Considerations](#)
- [Staff Training | Education](#)
- [Specialized Equipment](#)
- [Consultations](#)
- [Discharge](#)
- [Parent | Caregiver Education](#)
- [Follow Up](#)
- [Related Documents](#)
- [References](#)
- [Clinical Improvement Team](#)

TARGET POPULATION

Inclusion criteria

All bariatric surgery patients from day of surgery until discharge.

To be used by any hospital team member taking care of bariatric patients on day of surgery until discharge.

- Peri-op team
- Pharmacy team
- OR staff
- PACU team
- Anesthesia team
- Acute pain service
- PICU team
- Hospitalist team
- Nursing staff
- Surgical residents/fellows
- Radiology

BACKGROUND ON BARIATRIC SURGERY

The Bariatric Surgery Center at Children's Hospital Colorado offers bariatric (weight loss) surgery as a treatment option for severe obesity and obesity related health conditions in adolescents. Bariatric surgery can provide effective and sustainable weight loss for adolescents who have been unable to lose a significant amount of weight with traditional weight loss measures. The Bariatric Surgery team at Children's Colorado takes a multidisciplinary team approach to the treatment of obesity, collaborating with experts from lifestyle medicine, pediatric surgery, endocrinology, nutrition, social work, and pediatric psychology.

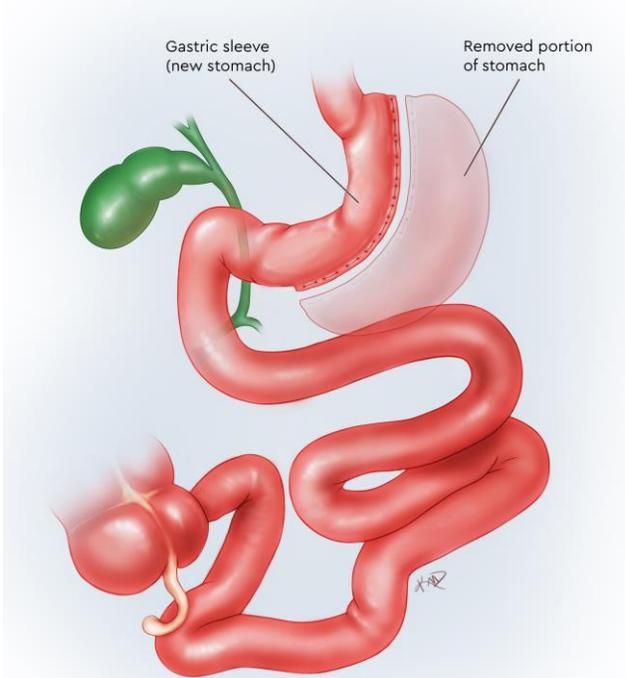
Types of surgery offered

The Bariatric Surgery Center currently offers two types of bariatric surgery options. These include the vertical sleeve gastrectomy (VSG) and the roux-en-Y gastric bypass (RYGB).

Bariatric surgery works by laparoscopically modifying the stomach (and intestinal tract for RYGB), reducing appetite and the amount of food needed to feel full.

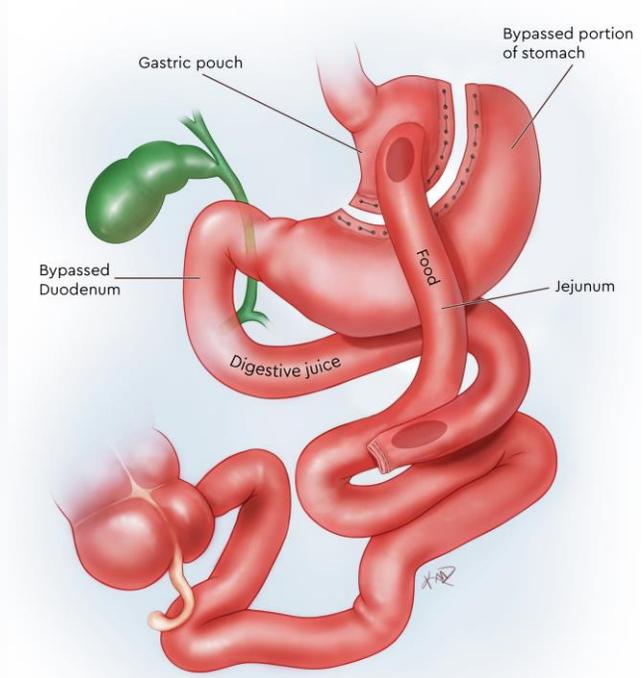
Adolescents and their parents must be willing to follow healthcare providers' recommendations before and after surgery. This includes committing to lifestyle changes that will help the teen remain healthy and keep the weight off for life. It also includes regular follow-up visits after surgery.

Vertical Sleeve Gastrectomy (VSG)



Copyright 2017 Regents of the University of Colorado. All Rights Reserved. Created by Kristina DeRycke.

Roux-en-Y Gastric Bypass (RYGB)



Copyright 2017 Regents of the University of Colorado. All Rights Reserved. Created by Kristina DeRycke.

Criteria for surgery

The Bariatric Surgery team carefully evaluates each patient to determine if they are a good candidate for surgery.

- BMI greater than 35 kg/m² or BMI greater than 120% with major obesity-related health conditions or a BMI greater than 40 kg/m² or BMI greater than 140% with other obesity-related health conditions
- Completion of growth

- Willingness to complete the pre-operative checklist
- Ability to understand surgery and the after care
- Understand and willing to adhere to nutritional guidelines after surgery
- Healthy family support system
- Clearance from the bariatric surgical team

INITIAL EVALUATION

Associated comorbidities

Bariatric surgery may help to reverse certain obesity-related conditions such as:

- Type 2 diabetes/insulin resistance
- Obstructive sleep apnea (OSA)
- Hypercholesterolemia/dyslipidemia
- Hypertension
- Musculoskeletal problems - i.e. slipped capital femoral epiphysis, Blount's disease
- Polycystic ovarian syndrome (PCOS)
- Non-alcoholic fatty liver disease (NAFLD)
- Gallbladder disease
- Pancreatitis
- Pseudotumor cerebri
- Skin breakdown/infections
- Psychosocial problems

OUTPATIENT CLINICAL MANAGEMENT

The bariatric multidisciplinary team performs a comprehensive medical, surgical, and psychological evaluation to determine which patients are a good candidate for surgery.

- Comprehensive medical and surgical evaluation
- Lab work
- Behavioral evaluation with psychologist
- Nutrition evaluation with registered dietitian
- Referral to specialists as needed (Sleep medicine/sleep study, Endocrinology, Cardiology, Gastroenterology, etc.)
- 3-6 consecutive months of medically managed weight loss
- Evaluation for long term birth control methods (females)

ANESTHESIA/RESPIRATORY CONSIDERATIONS

Preoperative evaluation

- Patient seen in Anesthesiology Preoperative Clinic within 1 week of surgery
- History and physical, airway and cardiopulmonary exam

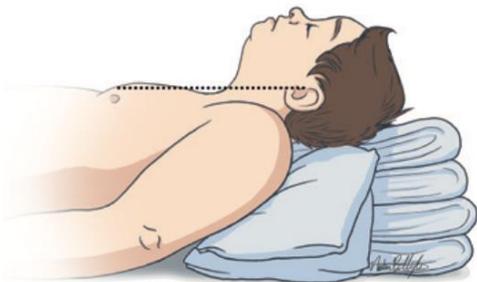
- Evaluation of obesity related comorbidities – diabetes, insulin resistance, hypertension, hyperlipidemia, obstructive sleep apnea (OSA), non-alcoholic fatty liver disease (NAFLD) etc.
- Plan for stopping medications prior to surgery i.e. stop Lisinopril 72 hours prior to surgery

Operating room set up

- Endotracheal tube (ETT) 7 or 7.5mm, Mac 3/Miller 2 blade
- Two peripheral IV set ups including fluid warmer
- Arterial line and central line are rarely necessary
- Glidescope available in operating room
- Ramp for induction and intubation
- Appropriate bed for obese patient
- Hoovermat for patient transfer
- 34, 36 and 38 Fr Bougie Dilators
- 18F OGT and 60 ml cath tip syringe for air insufflation may be requested by surgeon to check for anastomotic leak

Intraoperative management

- Standard monitors as recommended by the American Society of Anesthesiologists (ASA) - Use appropriate sized blood pressure cuff; conical shape of upper arm may necessitate using forearm or leg, expect low tidal volume electrocardiogram (EKG) and partial pressure of carbon dioxide (PaCO₂) / end-tidal carbon dioxide (EtCO₂) mismatch
- Ramped position for induction and intubation



- Adequate preoxygenation
- Rapid sequence induction with propofol, fentanyl and succinylcholine (maximum 150 mg)
- Desflurane, rocuronium and fentanyl for maintenance of general anesthesia
- Second peripheral IV access and fluid warmer
- Dexamethasone and ondansetron for postoperative nausea and vomiting (PONV) prophylaxis
- Intraoperative ventilation - Low tidal volume (6-8 mL/kg ideal body weight), modest levels of positive end-expiratory pressure (PEEP) 10-12 cm H₂O, maintain normocapnia, fraction of inspired oxygen (FiO₂) 0.5-0.8, intermittent alveolar recruitment
- Position in semi-recumbent (upper body - 25-30 degrees) or reverse Trendelenberg position
- Avoid supine or Trendelenberg position
- Extremities must be well padded to prevent peripheral nerve injuries
- Regional anesthesia not necessary as surgical procedures are laparoscopic
- IV acetaminophen and ketorolac may be used in the absence of nonalcoholic steatohepatitis (NASH)

- Anticipated blood loss is minimal
- Typically limit intravenous fluids to less than or equal to 1500mL (despite overnight deficit)
- Head up position prior to extubation
- Extubate when fully awake

THROMBOSIS CONSIDERATIONS

Patients with severe obesity may be at increased risk for venous thromboembolism (VTE). Patients will receive 40 mg enoxaparin subcutaneously on day of surgery and 40 mg enoxaparin subcutaneously every 24 hours while in the hospital. Patients are encouraged to ambulate with at least up to chair on day of surgery and ambulating every two hours while awake post-op day 1 until discharge.

THERAPEUTICS

Pre-op orders/medications

- Peripheral IV
- Apply sequential compression devices to both legs
- Type and screen
- Enoxaparin 40 mg subcutaneous
- Acetaminophen 15 mg/kg (Max dose of 650 mg) orally
- Scopolamine patch
- Cyanocobalamin 3000 mcg intramuscular injection once on operating room table
- Aprepitant 40 mg orally
- Less than 120 kg - cefazolin 2000 mg IV once
- Greater than or equal to 120 kg - cefazolin 3000 mg IV once
 - If anaphylactic reaction to penicillin - clindamycin 10 mg/kg (Max dose of 900 mg) IV once and gentamicin 2.5 mg/kg (Max dose of 120 mg) IV once

Inpatient pain management

Day of surgery

- IV ketorolac 0.5 mg/kg (Max dose of 30 mg) every 6 hours for a maximum of 24 hours
- Acetaminophen 15 mg/kg (Max dose of 650 mg) every 4 hours
- IV hydromorphone 0.01 mg/kg (Max dose of 0.5 mg) every 3 hours as needed if patient not tolerating oral and not resolved by ketorolac and acetaminophen

Post-op day 1 until discharge

- Ibuprofen 10 mg/kg (Max dose of 600 mg) every 6 hours
- Acetaminophen 15 mg/kg (Max dose of 650 mg) every 4 hours
- Oxycodone 0.1 mg/kg (Max dose of 5 mg) every 6 hours as needed

Home

- Acetaminophen 650 mg every 4 hours as needed for pain
- Oxycodone 5 mg every 6 hours as needed for breakthrough pain (10 tabs total provided with script)

Post-op orders/medications

- Standard precautions
- Vitals every 4 hours
- Daily weight
- Cardiorespiratory monitoring
- Strict intake and output
- Ambulate - at least up to chair day of surgery, ambulate every 2 hours while awake until discharge
- Apply sequential compression device to both legs
- Incentive spirometry 10 times every hour while awake
- Continuous pulse oximetry
- Diabetics glucose checks every 4 hours
- D5W 0.45% NaCl + potassium chloride 20 mEq/L IV at 75 mL/hr continuous
- Diabetics 0.9% NaCl at 75mL/hr
- Centrum kids with iron 2 chewable tablets daily
- Thiamine 100 mg IV every 24 hours
- Enoxaparin 40 mg subcutaneous every 24 hours
- Ondansetron 0.15 mg/kg (Max dose of 4 mg) IV every 6 hours
- Aprepitant 40 mg orally (Post-op day 1 only)

DIETARY CONSIDERATIONS

Bariatric Diet Stage 1

Sugar Free Clear Liquids from day of surgery until discharge or post-op day 2

- Order “Bariatric Surgery: Sugar-Free Clear Liquids (Diet Stage #1)”
- Liquids must be sugar free, calorie free, caffeine free, and clear
- No carbonation
- No straws or ice chips
- Offer: room temperature bottled water, sugar free crystal light packets, herbal tea, fat free low sodium chicken, beef, or vegetable broth

Bariatric Diet Stage 2

Full High Protein Liquids

- Order “Bariatric Surgery: Full High-Protein Liquids (Diet Stage #2)” if patient is not discharged on post-op day 2 and tolerating oral feeds

Nasogastric (NG) or Nasojejunal (NJ) tube feeds for post-operative bariatric patients

Enteral Feeding

1. If a bariatric surgery patient is readmitted after surgery due to poor oral intake, consult the inpatient RD for enteral nutrition recommendations if the patient has a short-term condition, and has functional, absorptive gut capacity.

2. Enteral nutrition will most often be delivered via nasojejunal (NJ) tube because of the significantly reduced volume/altered shape of the stomach (applicable to vertical sleeve gastrectomy (VSG) and roux-en-Y gastric bypass (RYGB)).
3. Inpatient dietitian will consult with the Bariatric Surgery Team outpatient dietitian to select formula, intake goals and rate.
4. Formula options:
 - a. Premier Protein oral supplement given as enteral feed (160 kcal and 30 g protein per 11-ounce carton, whey protein)
 - i. If Premier Protein is chosen, contact:
 1. Room Service Coordinators group at roomservicecoordinators@childrenscolorado.org or call x76232 (dial 1 as a clinician) to have cartons delivered to the patient room AND
 2. Email Dietitian Assistants group at dietitianassistants@childrenscolorado.org to let them know the formula is being delivered to the patient's room via Room Service and they can treat the enteral order as "floor stock"
 - b. Peptamen AF (1.2 kcal/ml, hydrolyzed-whey, high protein formula)
 - c. Alternative for patients with dairy-protein allergy: Liquid Hope (1.5 kcal/ml, 14g/8oz protein, whole food, vegan formula)
 - d. Beneprotein (6 grams of whey protein per scoop/packet) may be ordered as a supplement to meet protein needs at any post-op stage
5. Protein/Calorie guidelines for patients **without** hypermetabolic conditions, refer to the table below for specific intake goals according to post-op time period.

Post-Operative Diet Stages					
Time After Surgery	Stage#/Diet Order	Daily Calorie Limit	Protein Goal	Meal Volume (if eating PO)	Fluid Goal
Days 1 and 2	#1: Sugar Free Clear Liquids	Less than 300	N/A	1 oz every 15 min	64 – 80 ounces (1900 – 2400 ml) daily
Day 3 – 14	#2: Full High Protein Liquids	300 – 500	60 – 90 g/d	2 oz every 15 min	
Weeks 2 and 3	#3: Soft Protein Foods	About 500	60 – 90 g/d	¼ to ½ cup per meal	
Weeks 4 – 12	#4: High Protein Foods, Vegetables & Fruits	500 – 750	60 – 90 g/d	½ to 1 cup per meal	
Lifelong, after week 12	#5: High Protein Foods, Vegetables, Fruits & Whole Grains	About 1000	≥60 – 90 g/d	About 1 cup per meal	
References: (Nogueira and Hrovat); (Fullmer et al.); (Schollenberger et al.); (Kanerva et al.)					

6. Fluid goals for bariatric surgery patients in a euvolemic state are 64 – 80 ounces (1900 – 2400 ml) daily.
 - a. Patients should be encouraged to meet their fluid needs by mouth, as tolerated
 - b. For patients tolerating clear liquids by mouth, but no food or high protein shakes, an oral high-protein clear can be considered to supplement both fluid and protein needs
 - i. Premier Protein Clear: contact Room Service Coordinators at roomservicecoordinators@childrenscolorado.org or call x76232 (dial 1 as a clinician) to have bottles delivered to the patient room
 - ii. Beneprotein added to other tolerated sugar-free clear fluids (e.g. herbal tea, Crystal Light)
 - c. If fluids are not tolerated by mouth or if goals are not being met by mouth, additional free water should be added to the enteral feedings

STAFF TRAINING | EDUCATION

- Preserve dignity and privacy
- Lifting: use correct body mechanics, never lift alone

- Utilize mechanical lifting technology when necessary
- Assemble team and plan before entering room
- Bariatric stage 1 and stage 2 diet

SPECIALIZED EQUIPMENT

Bariatric equipment on 6th floor

- Large diapers or adult diapers
- X-large anti-embolism stockings (Ted hose)
- Sequential compression devices (SCDs)
- Large blood pressure cuff
- Large gowns
- Booties
- Large/simple/non-rebreather masks
- Laryngeal mask (LMA) size 4 and 5

CONSULTATIONS

Consider consultations

- Cardiology
- Pulmonary (CPAP management)
- Pain team
- Anesthesia
- Clinical nutrition (RD and/or MD)
- Endocrinology
- Gastroenterology
- Hematology
- Infectious Disease
- Orthopedics
- Physical therapy
- Skin/wound nurse
- Psychiatry
- Child Life

DISCHARGE

Discharge criteria

- Afebrile (less than 38.5°C) for 12 hours
- Tolerating stage 1 diet the last 6 hours without emesis
- Able to void and urine output greater than 200 ml over last shift

- Able to ambulate
- Jackson-Pratt (JP) drain is removed (if one was placed)
- Heart rate no greater than 120 beats per minute over past 12 hours
- Respiratory rate no greater than 25 breaths per minute over past 12 hours
- Oxygen requirement no greater than preoperative oxygen requirement

Discharge plan

- Over the counter Acetaminophen 650 mg orally every 4 hours as needed for pain
- Oxycodone 5 mg every 6 hours as needed for breakthrough pain (10 tabs total provided with script)
- Ondansetron 4 mg by mouth every 6 hours as needed for nausea
- Omeprazole 20 mg daily for the first 6 months, re-evaluate the need to continue taking at 6 months post-op visit
- Once at home, start Bariatric stage 2 diet (full liquid): Protein shakes + 64 oz fluids daily
- Take daily multivitamin, thiamine (vitamin B1), and calcium citrate/vitamin D
- Follow up with Bariatric team in outpatient clinic in 2 weeks

PARENT | CAREGIVER EDUCATION

Discharge instructions for patients and families

- Please seek medical attention for increasing pain, nausea, vomiting, fever greater than 101°F, respiratory distress, racing heart, decreased urination, or other concerns
- Okay to shower, allow Steri-Strips to fall off on their own
- Acetaminophen 650 mg orally every 4 hours as needed for pain
- Oxycodone 5 mg every 6 hours as needed for severe breakthrough pain after Acetaminophen
- Once at home, start Bariatric stage 2 diet (full liquid): protein shakes + 64 oz water daily. Consume all fluids slowly (2 ounces per 15 minutes). Stay on the protein shakes until your first follow-up visit. At your follow-up visit, you will receive education about how to transition to the next diet stage(s)
- Make sure to consume adequate fluids per day. Drink a minimum 64 ounces (8 cups) per day, made up of both Clear Liquids and Full Liquids (protein shakes)
- Take the following over the counter vitamin supplements previously approved by your bariatric outpatient dietitian:
 - 3 Flintstones Complete Hard Chewables daily or equivalent
 - Thiamine (vitamin B1) 100 mg 1 tab daily
 - Celebrate brand calcium citrate 500 mg/vitamin D 500 international units 3 times per day (lunch/dinner/bedtime) or equivalent (include # of tablets)
- Call Bariatric Nurse Practitioner with any clinical questions 720-777-5506
- For scheduling your follow up visit in clinic, please call 720-777-5202

FOLLOW UP

Follow up schedule with outpatient Bariatric Surgery team:

- 2 weeks
- 4-6 weeks

-
- 3, 6, 9, 12, & 18 month
 - Yearly

REFERENCES

1. Mechanick JI, Youim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient 2013 update. Cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and the American Society for Metabolic and Bariatric Surgery. *Surgery for obesity related diseases* 2013;9(2): 159-191.
2. Parrot J, Frank L, Rabena R, et al. American society for metabolic and bariatric surgery integrated health nutritional guidelines for the surgical weight loss patient 2016 update: Micronutrients. *Surgery for obesity and related diseases* 13(2017), 727-741. doi:10.1016/j.soard.2016.12.018.
3. Ross EL, Jorgensen J, DeWitt PE, Okada C, Porter R, Haemer M, Reiter PD. Comparison of 3 body size descriptors in critically ill obese children and adolescents: implications for medication dosing. *J Pediatr Pharmacol Ther.* 2014 Apr;19(2):103-10. doi: 10.5863/1551-6776-19.2.103.
4. Ross EL, Heizer J, Mixon MA, Jorgensen J, Valdez CA, Czaja AS, Reiter PD. Development of recommendations for dosing of commonly prescribed medications in critically ill obese children. *Am J Health Syst Pharm.* 2015 Apr 1;72(7):542-56. doi: 10.2146/ajhp140280.
5. Chidambaran V, Tewari A, Mahmoud M. Anesthetic and pharmacologic considerations in perioperative care of obese children. *Journal of Clinical Anesthesia* 45 (2018) 39–50.
6. Inge T, Courcoulas A, Jenkins T, Michalsky M, et al. Weight Loss and Health Status 3 Years after Bariatric Surgery in Adolescents. *New England Journal of Medicine*,374(2), 113-123. doi:10.1056/nejmc1602007.
7. Inge T, Jenkins T, Xanthakos S, Dixon J, Daniels S, Zeller M, Helmrath M. (2017). Long-term outcomes of bariatric surgery in adolescents with severe obesity (FABS-5): A prospective follow-up analysis. *The Lancet Diabetes & Endocrinology*,5(3), 165-173. doi:10.1016/s2213-8587(16)30315-1.
8. Duggan C, Watkins J, Koletzko B, Walker W. (2016). *Nutrition in pediatrics: Basic science, clinical applications.* Shelton, CT: Peoples Medical Publishing House-USA.
9. Diab L, Krebs N. (2018). Vitamin Excess and Deficiency. *Pediatrics in Review*,39(4), 161-179. doi:10.1542/pir.2016-0068.
10. Children's Hospital Colorado Vitamin D Deficiency Clinical Pathway (Approved 11/3/2014).
11. Butler C, Vidal-Alaball J, Cannings-John R, McCaddon A, Hood K, Papaioannou A, et al. (2006). Oral vitamin B12 versus intramuscular vitamin B12 for vitamin B12 deficiency: A systematic review of randomized controlled trials. *Family Practice*,23(3), 279-285. doi:10.1093/fampra/cml008.

CLINICAL IMPROVEMENT TEAM MEMBERS

- Tom Inge, MD | Pediatric Surgery
- Megan Kelsey, MD | Endocrinology
- Rachel Anthony, NP | Pediatric Surgery
- Richard Boles, PhD | Psychology
- Kelda Reimers, RD | Clinical Nutrition
- Brandy Garber, MSW | Clinical Social Work
- Jaime Moore, MD | Clinical Nutrition
- Eliza Buyers, MD | Gynecology Clinic
- Stephen Hawkins, MD | Pulmonary Medicine
- Dabe Chatterjee, MD | Anesthesiology
- Michele Loi, MD | PICU
- Todd Carpenter, MD | PICU
- Chris Derderian, MD | Pediatric Surgery Fellow

APPROVED BY

Clinical Pathways and Measures Committee – 2/18/19
 Pharmacy & Therapeutics Committee – 2/21/19

MANUAL/DEPARTMENT	Clinical Care Guidelines/Quality
ORIGINATION DATE	2/21/19
LAST DATE OF REVIEW OR REVISION	2/21/19
APPROVED BY	

REVIEW | REVISION SCHEDULE

Scheduled for full review on 2/21/23

Clinical pathways are intended for informational purposes only. They are current at the date of publication and are reviewed on a regular basis to align with the best available evidence. Some information and links may not be available to external viewers. External viewers are encouraged to consult other available sources if needed to confirm and supplement the content presented in the clinical pathways. Clinical pathways are not intended to take the place of a physician's or other health care provider's advice, and is not intended to diagnose, treat, cure or prevent any disease or other medical condition. The information should not be used in place of a visit, call, consultation or advice of a physician or other health care provider. Furthermore, the information is provided for use solely at your own risk. CHCO accepts no liability for the content, or for the consequences of any actions taken on the basis of the information provided. The information provided to you and the actions taken thereof are provided on an "as is" basis without any warranty of any kind, express or implied, from CHCO. CHCO declares no affiliation, sponsorship, nor any partnerships with any listed organization, or its respective directors, officers, employees, agents, contractors, affiliates, and representatives.

