Treatments and Nutrition Impact Symptoms	MNT: Common GI Matrix Dietary strategies for symptom management must be implemented to prevent malnutrition associated toxicities and reduced overall survival
Surgery Reviewed by Huhmann and August [1]	For malnourished patients only, initiate nutrition support for repletion of nutritional status pre-surgery, limiting LOS, morbidity and mortality. [2, 3] • Oral immune-enhanced formulas 5 days before/after surgery may have benefit[4] • TPN support is valid where EN is not possible. Other recommendations: • Limit NPO: introduce EN within 4 hours and begin oral supplements • Altered transit times are common and must be addressed. • Continue interventions to improve nutrition status in the 4 – 6 week recovery period prior to start of adjuvant therapy. Albumin and prealbumin is of little use assessing nutrition status post-surgery due to inflammation.
EC Fistulas related to surgery [10, 11]	• Evaluate for fluid/electrolyte losses, wound healing needs • Oral diet can increase output from small bowel fistulas, losing~ 75 g protein/day • Support: 1. 5 – 2 times basal energy, 1.5 – 2.5 g/kg protein. Twice the RDA for vitamins/trance minerals (minimum), and may need up to 10x vitamin C, zinc. Monitor folic acid, B12, copper. • EN below the fistula or TPN/bowel rest may support spontaneous closure, limit complications • Octreotide may assist with closure due to inhibition of GI secretions and motility. • High output fistulas (> 500 cc/day) warrant use of TPN, acid suppressive therapies, anti-diarrheals.
Hepatic resection of tumor	Monitor for hypoglycemia secondary to decreased glycogen storage while liver regenerates over 4-6 weeks.
Small bowel obstruction [8]	Commonly related to 1) post op adhesions (35% by 10 years), less common if laparoscopic, 2) malignant tumors (ovarian, CRC, small bowel, peritoneal metastases), 3) strictures due to radiation. **Treatment options:** 1) IV hydration, nasogastric suction may resolve over 2 – 5 days. 2) Surgery, if there is strangulated bowel or escalating symptoms 3) Stents may alleviate obstruction and allow resumed oral intake and tolerance of chemotherapy, but can re-occlude. Include soft, moist, lower fiber foods. **Recommendations with partial SBO/high risk:** • Smaller, more frequent meals, chewing foods thoroughly, limiting insoluble fiber. • Return to liquid diet at first sign of obstructive symptoms: i.e. intermittent cramping pain with abdominal distention, inability to pass gas/constipation, and vomiting. • Liquids are safest, including anything that can be sucked through a straw. This permits juicing, though with high-end blenders fiber remains and could contribute to gas and bloating. Advance volumes slowly, consulting MD if symptoms worsen. Resource: Dinner Through a Straw; Patti Thigpen • Staying upright and walking after meals improves GI motility • Education analogy: A 4-lane freeway has narrowed to a bike lane.
GI obstruction not amenable to stents or surgery	• Tube-feeding distal to obstruction • TPN: where response to treatment is expected, allowing later transition to EN/PO
Venting ostomy for obstruction	**Plus:** Allows eating/drinking small volumes for pleasure and relieves pain **Minus:** • Loss of gastric secretions in significant volumes risks dehydration and hypochloremic metabolic alkalosis due to lack of distal reabsorption. • Consider limiting oral intake with large volume output, to reduce losses of fluid and electrolytes, particularly chloride, that exceed any benefit. • Monitor for efficacy of any oral medications. Clamp as tolerated and consider possible benefit of reinfusion of intestinal secretions where there is > 500 cc of gastric output. Parrish and Quatrara[9] review this process, in an article available on the UVA site: www.ginutrition.viriginia.edu

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TPN Support	• If LFTs are > twice normal and other causes are ruled out: cycle TPN, limit lipids to < 0.5 g/kg, avoid over-feeding, and combine with EN where feasible. • In clinical practice, addition of 1 gram L-carnitine (20 mg/kg) may improve utilization of lipid calories and reduce elevated triglycerides.
Enteral support	• Feeding tube placement is a higher risk in severely malnourished patients, or those with ascites, varices, or portal hypertension.[13] • Delivery via gravity drip feeding bags versus syringe feedings improves tolerance. • Further slowing requires continuous feeds via pump. Cycling of feeds improves QOL and compliance.
Bile acid losses	Obstruction distal to common bile duct with decompression above, or with external biliary drains will reduce the bile salt pool that typically recycles via the terminal ileum. A loss of > 100 cm creates deficiency; reduces fat absorption ~ 40%. • Consider reinfusion of biliary secretions via Y port: 100 - 200 mL q 4 – 6 hours to coincide with enteral feedings. • Consider semi-elemental formula where there is ongoing malabsorption.
B-12 Deficiency [12] Serum B12 < 300 pg/ml	Common in: • Short bowel or loss of > 20 cm of ileum, gastrectomy, radiation enteritis, cirrhosis, achlorhydria with aging or chronic PPI use; metformin use • Liver disease limits storage capacity/reserves, though serum levels may be elevated with liver destruction; check methylmalonic acid (MMA) levels. • Oral replacement with synthetic B12 is effective for vast majority. 1000 mcg/day for 4 weeks followed by 500 mcg/day for maintenance • IM dosing needed with severe short bowel, ileal resection and non-compliant patients
Ascites	• Fluid calories tolerated > solids • Encourage liquid protein sources to compensate for losses via paracentesis • Relative contraindication for gastrostomy tube placement; radiologic placement is possible [13] • Malignant ascites predicts < 3 month survival.
Radiation Site specific impact	• Soft foods, fluids with calories. Low fiber diet if indicated. • Ensure hydration to limit exacerbation of nausea/vomiting and diarrhea. • Chronic radiation enteritis can develop over 6 – 18 months, with irreversible decrease in absorptive area of small bowel. • Obstructive symptoms with late-effect radiation proctitis benefit from constipation management including stool softeners.
Gastroparesis Under-diagnosed cause of nausea, vomiting, early satiety and abdominal pain	Dysmotility is common in upper GI cancers. Multifactorial: surgical, tumor infiltration of the celiac plexus or vagus nerve; comorbidities: diabetes, hypothyroid; narcotic associated slowing. [14] **Mild nutritional impairment:** • Ginger at 500 - 550 mg TID has been effective in practice. Alternatively, prescribed prokinetics: metocopramide (5 – 10 mg before major meals and HS) or erythromycin; plus antiemetics • Multiple small meals: limiting fiber and fat that can slow emptying • Fluids with fat/calories empty > solids and can help meet caloric, fluid and vitamin needs. • Sitting upright to eat and walking after meals will promote emptying **Severe impairment** may require hospitalization to correct fluid/electrolyte balance, with IV prokinetics and antiemetics, NG decompression, or surgical stent placement for palliation of tumor obstruction/compression. • Consider jejunostomy tube placement with > 10% weight loss
Constipation due to pain meds	• Titrate OTC medications with any change in narcotics. Clinical practice includes use of up to twice the package recommendations.
Gas	• Beano: fiber related lower abdominal gas), Simethicone/GasX: to disperse gas bubbles • Eliminating fermentable carbohydrates reduced issues with gas [16]
Diarrhea	• Educate re maximum daily doses of Immodium (8 – 10) or Lomotil (8). Rule out C. difficile, before adding anti-diarrheals. Where persistent, tincture of opium or octreotide may be helpful • VSL#3 improved remission of c. difficile diarrhea. • Probiotics in general may benefit underlying IBS and antibiotic related diarrhea[15].

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Malabsorption secondary to disease or surgery	• Implement pancreatic enzyme replacement and consider Proton Pump Inhibitors/PPI to improve efficacy of PERT, and anti-diarrheals to slow transit. • Concurrent narcotics may limit diarrhea, but other symptoms will be present, such as gas/bloating, foul odors and floating stools. • Semi-elemental formulas work best with continuous feedings. • Monitor retinol-binding protein as marker of fat soluble vitamin malabsorption, consider supplementation with water-soluble versions as needed. • Vitamin D lamps may replete levels with short bowel; www.sperti.com
Dehydration	Review symptoms and consequences; offer samples to expand variety, acceptance.
Electrolyte Imbalance, due to meds, diarrheal or venting losses	• Monitor treatments that will influence electrolyte status and educate re food sources • Education to limit side effects of oral supplements: K to be taken with food (nausea), Mg Plus Protein can limit magnesium related diarrhea • Recommend IV supplementation where oral supplements are not feasible.
Neutropenia	Food safety precautions
Tumor Markers Re treatment response	• Alpha-fetoprotein (AFP): Liver • CEA: Colorectal cancers • CA 19-9: Gallbladder, bile duct, gastric
Treatments and Nutrition Impact Symptoms	**MNT: CRC Matrix** **Dietary strategies for symptom management must be implemented to prevent malnutrition associated toxicities and reduced overall survival**
Colectomy with reanastomosis	• Monitor hydration and electrolyte status, pending small bowel adaptation. • Where terminal ileum was resected: o Monitor B12 (Common Matrix) o Recommend bile acid sequestrants for choleretic diarrhea.
Rectal resections	• Monitor for issues with low anterior resections, chemoradiation.
Colostomy	• Educate and refer to www.uoaa.org • Diverting: for rectal radiation, to allow healing of a fistula, or decompression. • Permanent: in UC, pelvic exoneration or removal of the anus and rectal sphincter.
Ileostomy	• Educate/refer to www.uoaa.org • Assess, and manage fluid and electrolyte imbalances due to average output of 500 -1300 ml/day. • Increase fluids by at least 500 ml, including electrolyte solutions, sports drinks, broth, and vegetable juices to cover losses of sodium and potassium.
J-pouch	• Monitor for pouchitis, though less common in FAP than IBD o Acute pouchitis is easily treated with antibiotics; but chronic can be difficult to manage. VSL #3 probiotics maintained remission in 85% 58 • Education re anti-diarrheal meds and diet therapies
Diarrhea	• Refer to common GI matrix, with concern re maintaining hydration • Consider cholestyramine with ileal resections, due to bile salt malabsoption
Vitamin levels, supplementation	• Monitor serum vitamin D levels, supplementing to maintain normal levels • Encourage calcium in diet, supplement to a total of 1300 mg/day for prevention • Magnesium supplementation at 50% of calcium values (adjusting for diarrhea) • B12, where ileal resection occurred. • Folate remains controversial, best limited to 400 mcg

Treatments and Nutrition Impact Symptoms	MNT Dietary strategies for symptom management must be implemented to prevent malnutrition associated toxicities and reduced overall survival
Gastrectomy	**Pre-op:** Small, frequent intake of soft foods and fluids to address weight loss but limit obstruction. **Post-op:** Early oral intake is safe, using water day 1 – 2, with small volumes of soft foods added six times a day on day 3. **J- tube feedings for support while advancing to a soft diet**. • Continuous feedings, typically tolerated at 65 – 80 cc/hour via pump • Bolus feeds are rarely tolerated. Consider a very slow drip from gravity bags where a pump is not available. • Fiber-free 1.0 standard formula over 18 – 20 hours, advancing as tolerated • Toddler sized volumes, high in protein, low in fiber, 6 – 8 times a day for six months or weight stabilization. Addresses early satiety, limited reservoir, risk of dumping and hypoglycemia • Food must be chewed thoroughly before swallowing • Food safety education, with increased risk due to lack of gastric acid
Sub-total resections	• Antibiotic treatment of H. pylori is essential; “triple therapy”, two antibiotics + PPI • Address impact of antibiotics on appetite and GI function • Low sodium diet, as sodium works synergistically with H. pylori, increasing risk
Reflux/GERD	Improves with time; but will always require smaller, more frequent meals and 30 degree elevation of the head while sleeping.
Dumping Syndrome	• Follow anti-dumping diet and recommendations • Monitor hydration, often an issue if it is necessary to separate fluids from solids. • Sugar substitutes will often cause abdominal cramping & nausea > sugar
Osteoporosis risk and interventions Review article in Practical Gastroenterology 3/2013; Carey	Increased risk post-gastrectomy due to 1) altered intake, 2) higher losses of calcium and D in the presence of malabsorption with formation of insoluble calcium soaps, 3) lower rates of absorption with dumping, rapid transit times and bypass of absorptive region of the duodenum/jejunum, 4) absence of stomach acid in lowering pH of the proximal duodenum, and lack production of gastrocalcin in the stomach mucosa, normally stimulating bone uptake of calcium, 5) other primary risk factors and impact of inflammation on osteoclastic activity. • DXA scan q 2 years with low BMI, significant weight loss, other risk factors. • Encourage sun exposure and monitor vitamin D levels; supplement prn • Calcium at 1500 mg/day, as calcium citrate; divided doses and separate from iron-rich foods or oxalates. • Lifestyle recommendations to quit smoking, limit alcohol, and increase weight bearing exercise.
Supplements needed therapeutically	• Monitor iron stores, due to altered absorption post-gastrectomy. Review strategies to maximize iron absorption. • Monitor B12, supplement prn • Consider multiple vitamin where absorption is questionable

Treatments and Nutrition Impact Symptoms	MNT for HCC/Bile Duct Tumors Dietary strategies for symptom management must be implemented to prevent malnutrition associated toxicities and reduced overall survival
Liver resections	• Peri-operative support reduced morbidity, mortality [104] • Jejunostomy placement allows early enteral support post-surgically. • Monitor for refeeding risk
Supplementary Enteral Nutrition ESPEN guidelines [105]	• Preferred: oral • 35 -40 kcal/kg/day; 1.2 – 1.5 g protein/kg/day • Whole protein formulas -BCAA-enriched only when hepatic encephalopathy arises during supplementation -Concentrated formulas with ascites • Tube feeding where unable to maintain adequate oral intake -PEG placement is associated with complications, and is not recommended. -Best via NG, if tolerated (monitor variceal bleeding risk) or jejunostomy
Diet modifications	• Eliminate <u>unnecessary</u> diet restrictions that impact palatability and intake • Where needed, restrict sodium to 2 g/day to limit fluid retention/portal hypertension. • Fluid restriction is not advised unless serum sodium is < 125 mEq/L - Fluids may be used to deliver calories via medical nutrition supplements • Moderate protein: 1.2 – 1.5 g/kg -Restrictions simply result in higher ammonia levels and muscle breakdown. -Branched chain amino acids are controversial, and not recommended unless there is uncontrolled encephalopathy. • Limit iron to <7 mg/day if serum ferriten is elevated [93] • Small, frequent meals, 6 – 8 times a day decrease the duration of overnight fasting which is problematic due to impaired gluconeogenesis and glycogen reserves
Nutrition Assessment	• Challenges include limited hepatic synthesis, fluid shifts, and changes in nutrient metabolism • Mild ascites reflects 3 – 5 kg of fluid weight, moderate 7 – 9 kg, severe >14 kg. • Harris Benedict underestimates REE significantly [106] • Follow hand strength and mid arm circumference, if possible [84]
Ascites	• Small, frequent meals and snacks to address early satiety • High caloric fluids may be especially well tolerated, and limit issues with fluid balance • Typically treated with diuretics; monitor potassium levels.
Encephalopathy [107]	• Medical management with lactulose +/- Rifaximin • Moderate protein; 0.8 – 1.3 g/kg, BCAA may be used if needed • Zinc deficiency is common and may exacerbate encephalopathy and limit taste and smell
Alcohol Abuse	Oral/fluid supplements offer vitamin/nutrient support and may be more acceptable
Supplements needed therapeutically	• Thiamine repletion in alcoholic or Hep C cirrhosis • Deficiencies common in alcoholics, most benefit from a multiple vitamin unless delivered through oral supplements

Treatments and Nutrition Impact Symptoms	MNT for GI Carcinoid (NET) Dietary strategies for symptom management must be implemented to prevent malnutrition associated toxicities and reduced overall survival
Testing: 5-HIAA	• Avoid serotonin rich foods, <u>only in the 24 hours prior</u> to urine collection Sources: Walnuts, pecans, bananas, kiwi, plums, tomatoes, plantains, avocados, dates, grapefruit, cantaloupe, many nuts, olives, eggplant • Post testing: return to usual diet
Somotostatin Analog Therapy: 1) Malabsorption, with steatorrhea, gas & bloating	• Monitor for malabsorption and cholelethiasis as Sandostatin analogs limit pancreatic and gallbladder function, • PERT

2) Malabsorption of Fat-Soluble Vitamins	• Monitor retinol-binding protein as a marker of fat soluble vitamin malabsorption. Supplement fat-soluble vitamins, prn. • Check vitamin D levels
3) Hyperglycemia	Monitoring of glucose tolerance
4) Hypothyroid	Monitoring of thyroid function, weight gain
Diarrhea and Dehydration	• Coordinate with team to optimize somatostatin-analog therapy and PERT • Address hydration issues and diet modification for diarrhea
Niacin Deficiency; Pellagra as scaly patches on skin	• 25 -50 mg niacin as niacinamide or niacin + half a baby aspirin; to limit flushing • High protein diet, 1.5 g/kg body weight
Flushing	• Limit alcohol, spicy foods and foods with high tyramine or dopamine content, stimulating catecholamine production [114] • Avoid large meals, excessive exercise and emotional distress
Asymptomatic	Follow ACS and AICR guidelines

Factors Increasing Risk for GI Cancers[18]

	Gastric	CRC	Hepatacellular	Cholangio: ICC	Cholangio:ECC	Gallbladder
Alcohol	Heavy 1.65[63]	1.21 - 1.52[25]	17%/10g/day[18] Any alcohol with NAFLD[71]	Heavy Use		
Obesity	GEJ only[62]	1.51[21] Colon > Rectal	1.91 M 1.55 F[73]	+		
Insulin Resistance		1.2 – 2x[21, 23]	➢ 2[76, 77]	1.97[102]	1.63[102]	1.52[110]
Sedentary		+	+ in NAFLD/NASH			
Iron Excess	+	+	+[70]			
Sodium	+++					
Red Meat	++[64]	15%/50 g[26]				
Processed Meat	+++	21%/50 g[26]				
Cirrhosis			+++	++	+	
Hepatitis B			10 – 25% lifetime[68]			
Hepatitis C			15x[69]	2x[69]	1.5x	
Primary Sclerosing Cholangitis		Major[99]		Major[99]	Major[99]	
IBD				Possibly via PSC		
Cholelithiasis				+	+	3% → GBC
Environmental	H. Pylori		Aflatoxin Arsenic Betel nuts	Parasitic liver flukes		6% risk with Salmonella typhi infection
Smoking	Doubled risk	=	+	+	+	
Sex	2 x M > F					2 – 3x F > M