

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



دانشگاه علوم پزشکی  
و خدمات بهداشتی درمانی تهران  
دانشکده علوم تغذیه و رژیم درمانی  
گروه تغذیه بالینی



## حمایت های تغذیه در جراحی های باریاتریک

ارائه دهنده:  
دکتر خالوئی فرد  
متخصص تغذیه بالینی  
هیئت علمی دانشگاه علوم پزشکی تهران

تابستان ۱۴۰۱

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# WHAT IS ERAS?



# What is ERAS?

- ERAS programs are multimodal, evidence-based care improvement processes that bundle  $>20$  care elements throughout the perioperative period and consistently demonstrate improved postoperative outcomes in a variety of surgical settings.
- The goals are to manage the stress response to surgery, maintain body stores, and improve physiological function for early recovery.

Mid-thoracic epidural  
anesthesia/analgesia  
No nasogastric tubes  
Prevention of nausea and vomiting  
Avoidance of salt and water overload  
Early removal of catheter  
Early oral nutrition  
Non-opioid oral analgesia/NSAIDs  
Early mobilization  
Stimulation of gut motility  
Audit of compliance and outcomes

Preadmission counseling  
Fluid and carbohydrate loading  
No prolonged fasting  
No/selective bowel preparation  
Antibiotic prophylaxis  
Thromboprophylaxis  
No premedication

**Postoperative**

**Preoperative**

**ERAS**

**Intraoperative**

Short-acting anesthetic agents  
Mid-thoracic epidural anesthesia/analgesia  
No drains

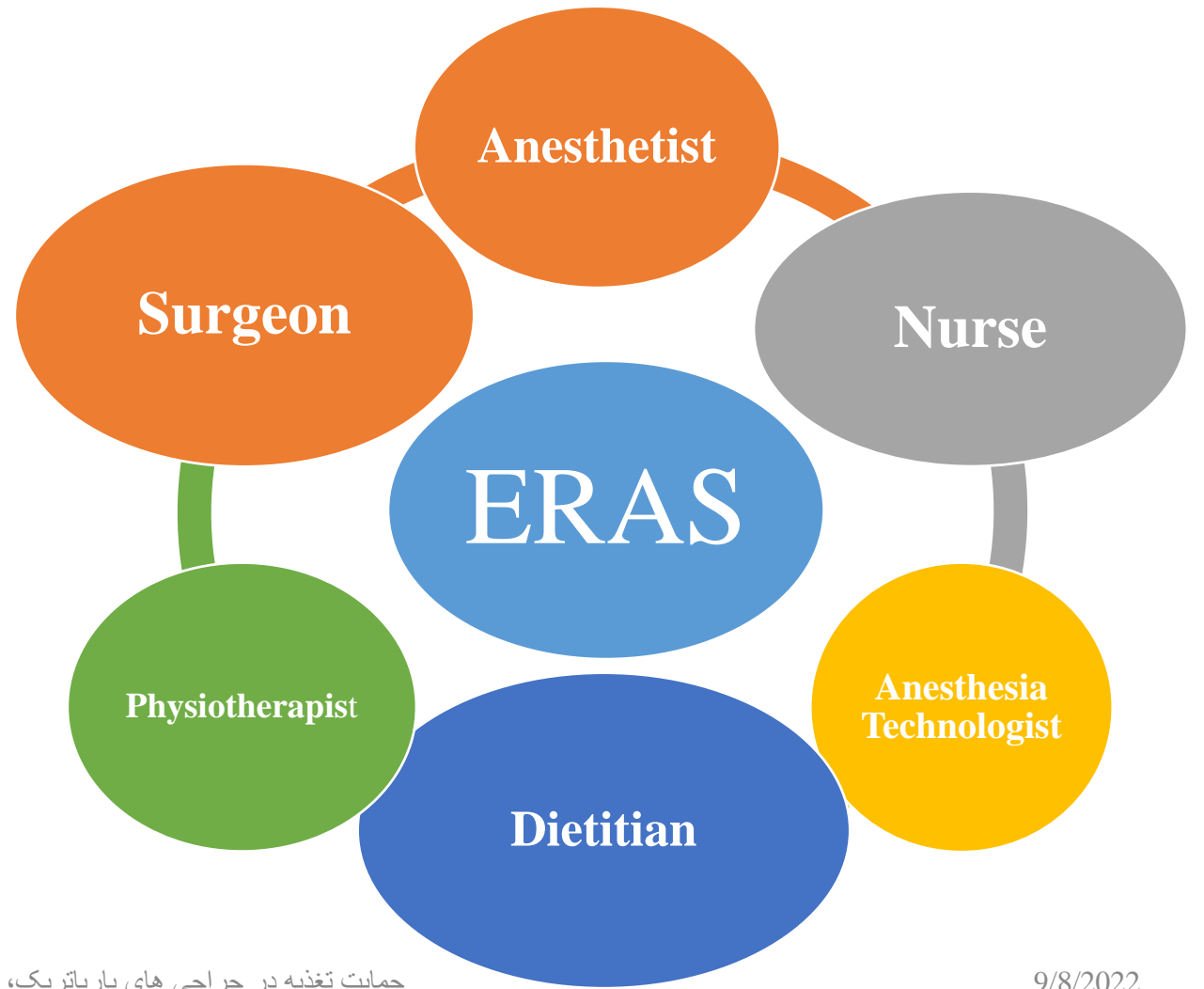
Avoidance of salt and water overload

Maintenance of normothermia (body warmer/warm intravenous fluids)





# ERAS implementation is complex and requires a collaborative team approach.



# Guidlines of ERAS (21)

- Gastrectomy / orthopaedic
- **Bariatric**/ gastrointestinal / pancreatic
- Breast/ gynaecology/ thoracic
- Cardiac/ liver/ urology
- Colorectal/ lumbar-spinal-fusion/ vascular
- Cytoreductive/ neonatal
- emergency-laparotomy/ obstetrics
- head-neck/ oesophagectomy

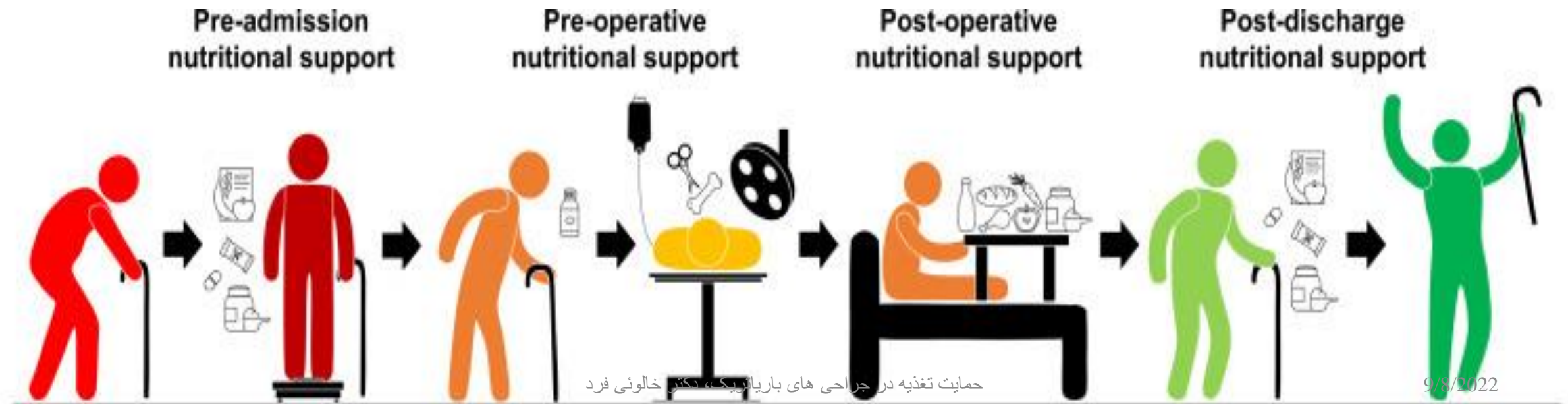




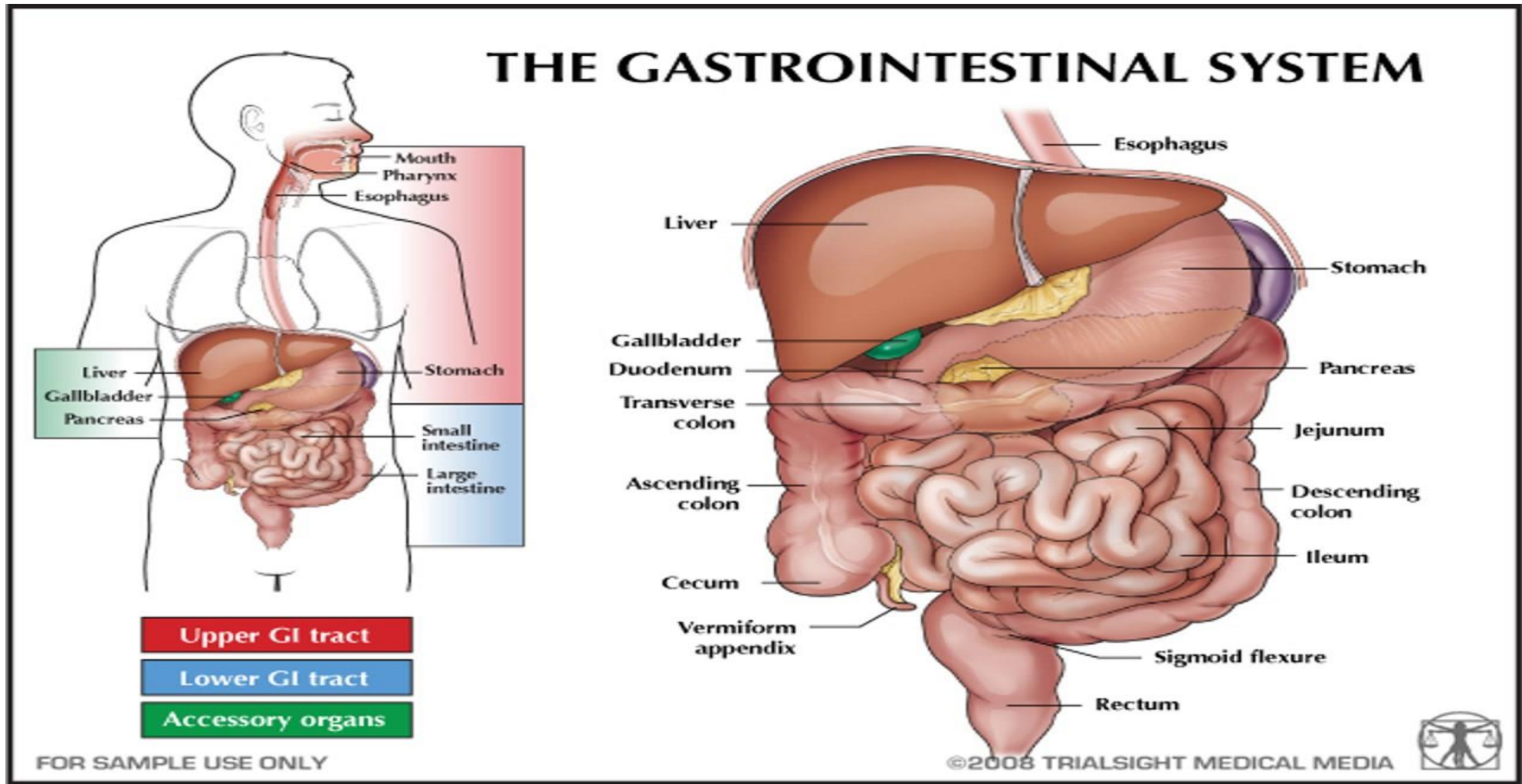


# ERAS and nutrition

- Nutritional support came to be regarded as a Panacea for all surgical ills.



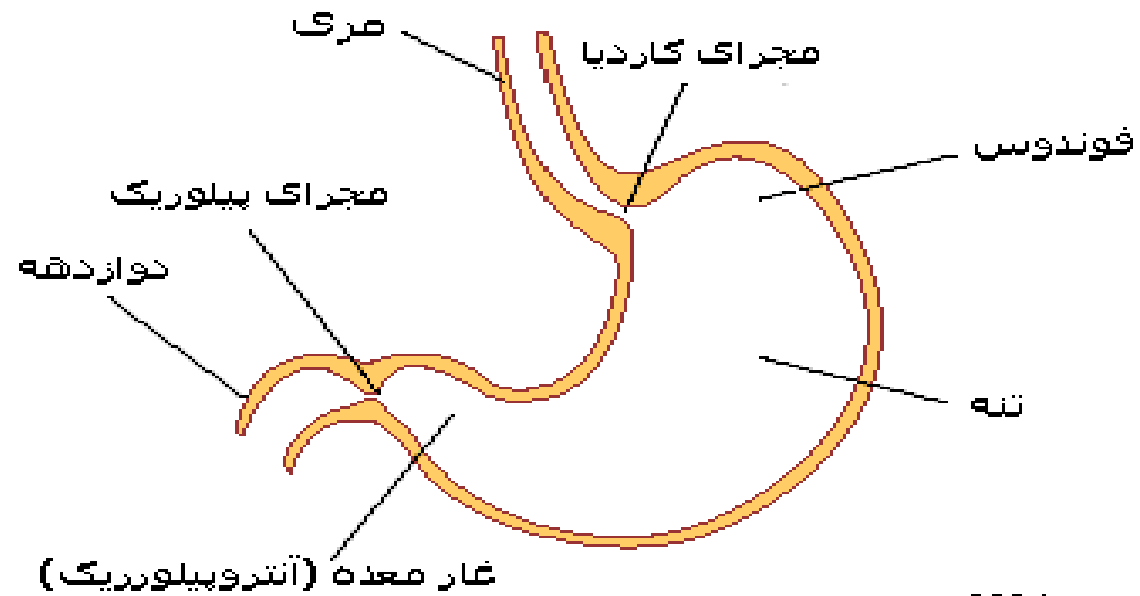
# آناتومی



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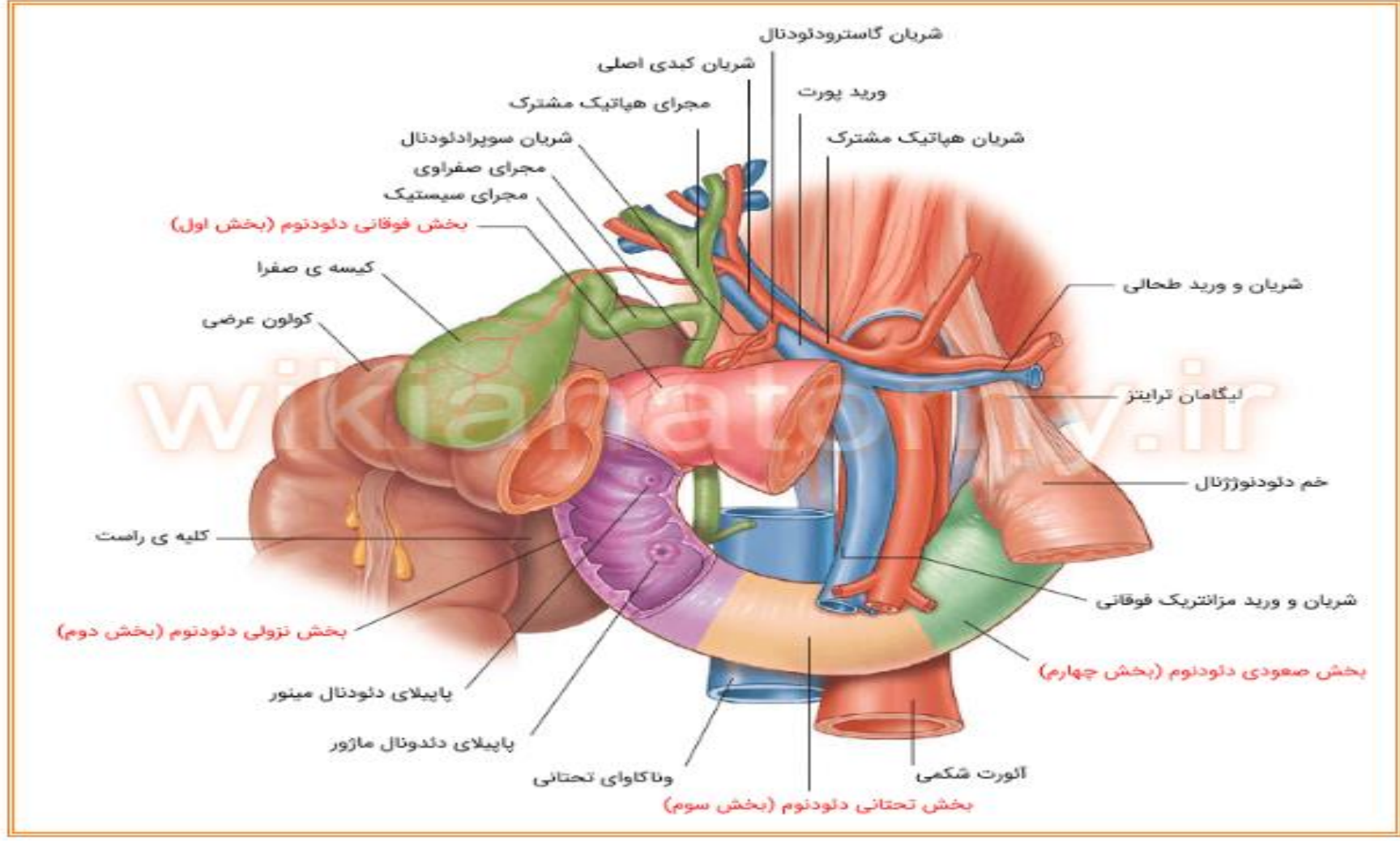
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## ساختمان معده



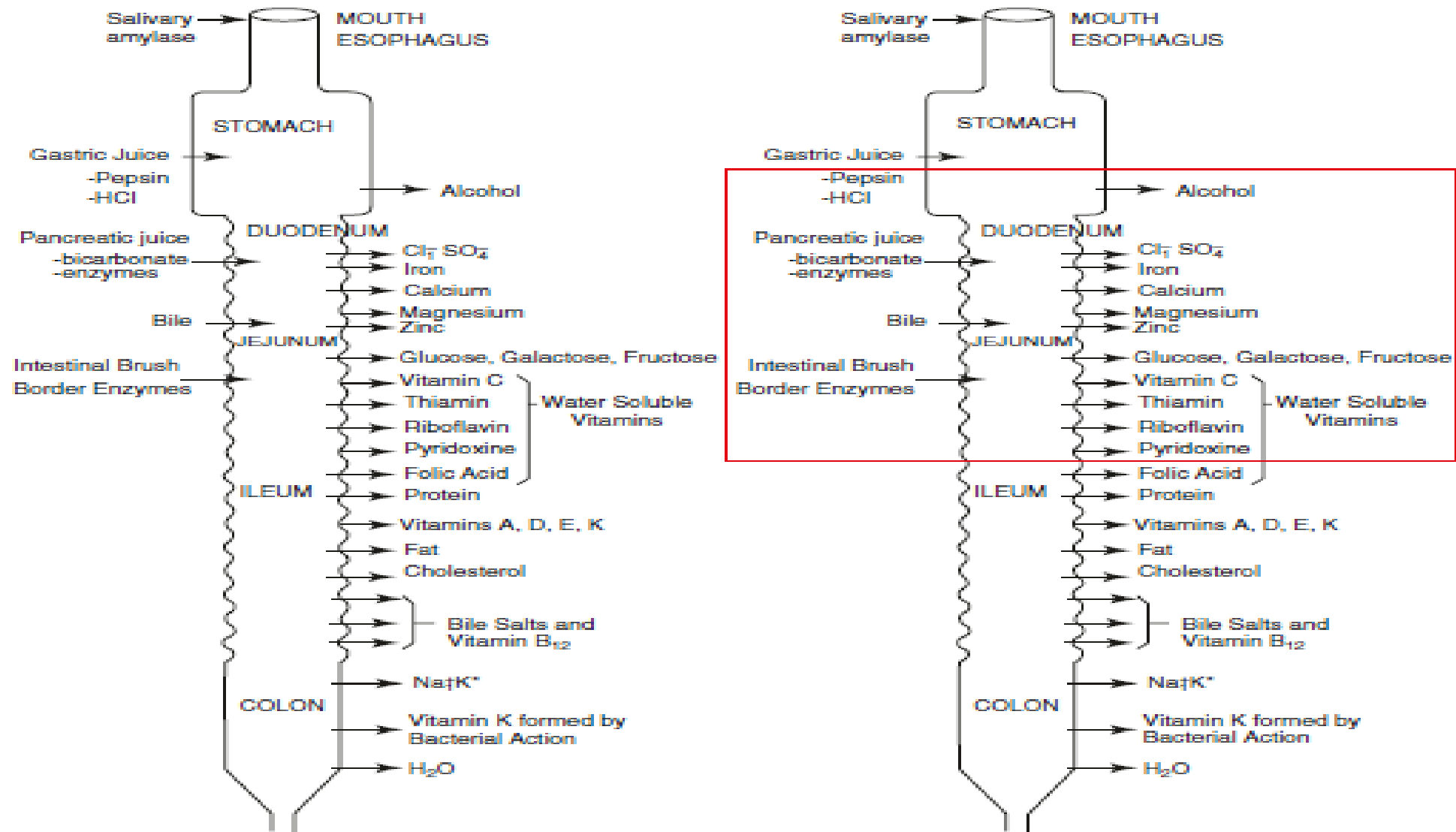
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# آناتومی



بخش های دودنوم

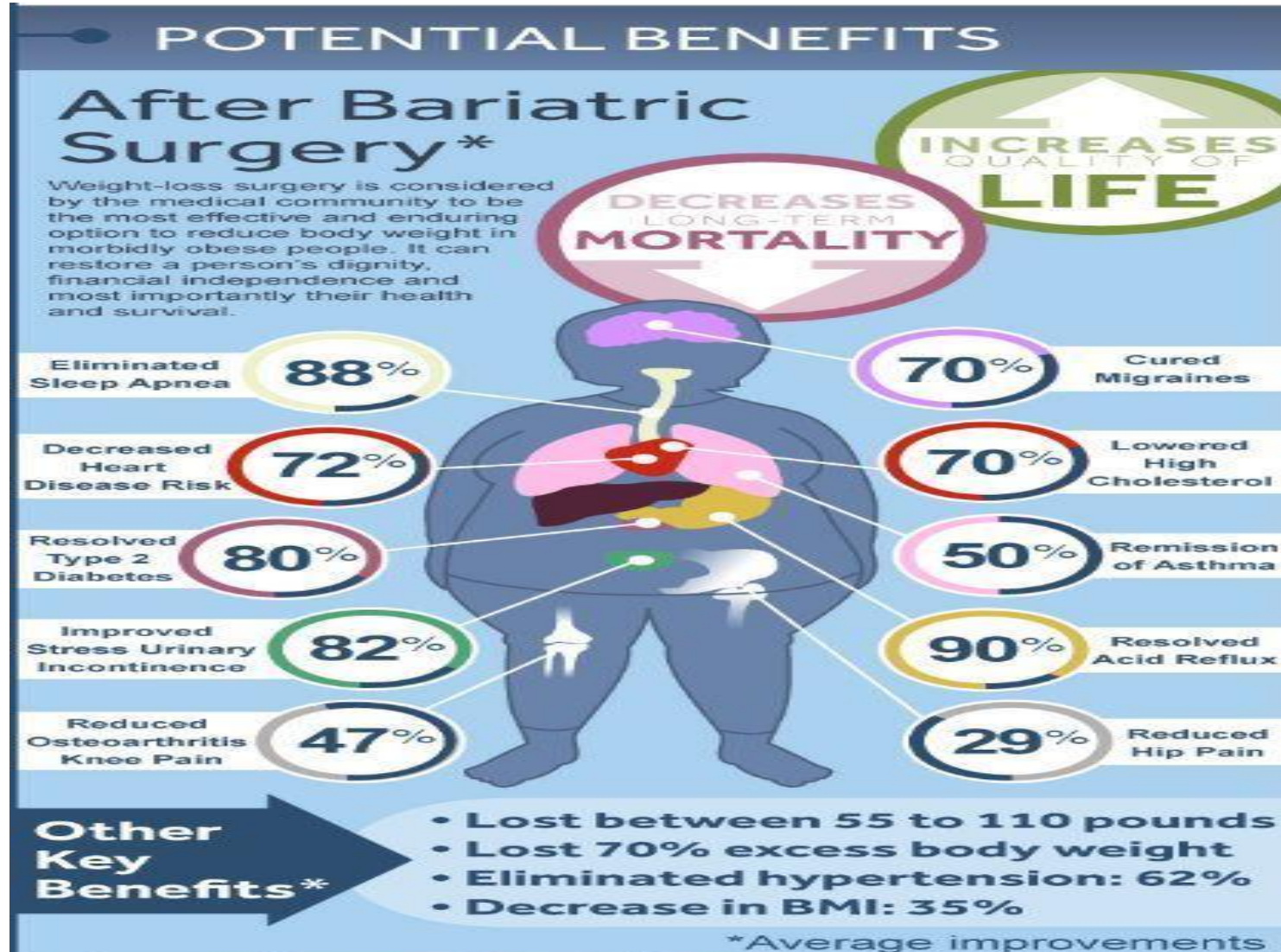
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**Fig. 9.1** Schematic representation of sites of absorption of various nutrients in the GI tract. Figure on the right shows nutrients absorbed from the excluded portion of GI tract in MGB-OAGB in the red box



## فواید جراحی های باریاتریک



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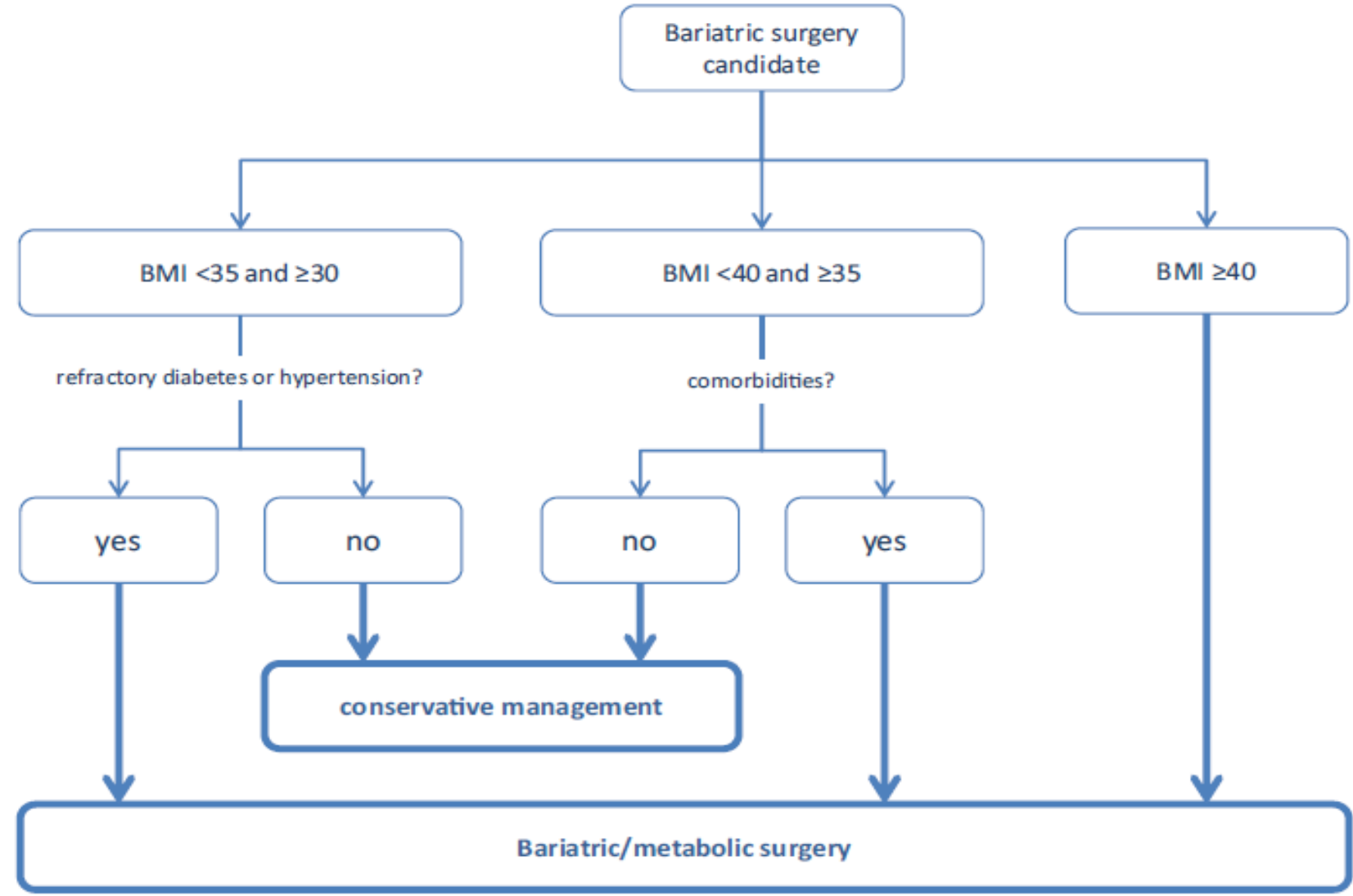


## تفاوت جراحی متابولیک با باریاتریک:

بای پس معده و مینی گاستریک بای پس تا ۹۳٪ باعث بهبود کامل دیابت تیپ II می شود.  
گاستریک باندینگ تا ۵۰٪ باعث بهبود دیابت می شود.  
گاستریک اسلیو تا ۷۰٪ باعث بهبود دیابت می شود.  
دئودنال سوئیچ و اسلیوگاسترکتومی + دئودنوایلئال بای پس تا ۹۷٪-۹۸٪ باعث بهبود دیابت می شود.



## اندیکاسیون های جراحی باریاتریک



## Q1. Which patients should be offered bariatric procedures?

R1. (2019\*). Patients with a BMI 40 kg/m<sup>2</sup> without coexisting medical problems and for whom bariatric procedures would not be associated with excessive risk are eligible for a bariatric procedure (Grade A; best evidence level [BEL] 1).

R2. (2019\*). Patients with a BMI 35 kg/m<sup>2</sup> and 1 severe ORC remediable by weight loss, including T2D, high risk for T2D (insulin resistance, prediabetes, and/or MetS), poorly controlled HTN, NAFLD/nonalcoholic steatohepatitis (NASH), obstructive sleep apnea (OSA), osteoarthritis of the knee or hip, and urinary stress incontinence, should be considered for a bariatric procedure (Grade C; BEL 3).

Patients with the following co-morbidities and BMI 35 kg/m<sup>2</sup> may also be considered for a bariatric procedure, although the strength of evidence is more variable: obesity-hypoventilation syndrome and Pickwickian syndrome after a careful evaluation of operative risk, idiopathic intracranial HTN, gastroesophageal reflux disease (GERD), severe venous stasis disease, impaired mobility due to obesity, and considerably impaired quality of life (Grade C; BEL 3).

## Q1. Which patients should be offered bariatric procedures?





R3. (2019\*). Patients with BMI 30 to 34.9 kg/m<sup>2</sup> and T2D with inadequate glycemic control despite optimal lifestyle and medical therapy should be considered for a bariatric procedure; current evidence is insufficient to support recommending a bariatric procedure in the absence of obesity (Grade B; BEL 2).

**R4. (NEW). The BMI criterion for bariatric procedures should be adjusted for ethnicity (e.g., 18.5–22.9 kg/m<sup>2</sup> is healthy range, 23–24.9 kg/m<sup>2</sup> overweight, and 25 kg/m<sup>2</sup> obesity for Asians) (Grade D).**







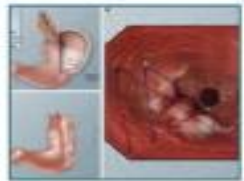


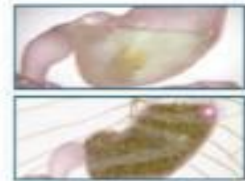
R5. (2019\*). Bariatric procedures should be considered to achieve optimal outcomes regarding health and quality of life when the amount of weight loss needed to prevent or treat clinically significant ORC cannot be obtained using only structured lifestyle change with medical therapy (Grade B; BEL 2).

## انواع جراحی های باریاتریک

### SURGICAL PROCEDURE

	
Roux-en-Y Gastric Bypass	Gastric Banding
	
Sleeve Gastrectomy	Biliopancreatic Diversion with Duodenal Switch

### NON-SURGICAL PROCEDURE

				
ReShape Balloon	Ellipse Balloon	Spatz Balloon	Obalon Balloon	Orbera Balloon
				
POSE Procedure	Gastroplasty Apollo Device	Aspire Assist	Transpyloric Shuttle	Gelesis 100



## انواع جراحی های باریاتریک

# *BARIATRIC SURGERY* روشهای جراحی چاقی

### الف - روشهای محدود کننده :

- گاستریک باندینگ (Gastric Banding)
- اسلیو گاسترکتومی (Sleeve Gastrectomy)
- پلیکاسیون (Plication)

### ب - روشهای سوء جذب:

- بای پس قسمتی از دستگاه گوارش (روده ها)

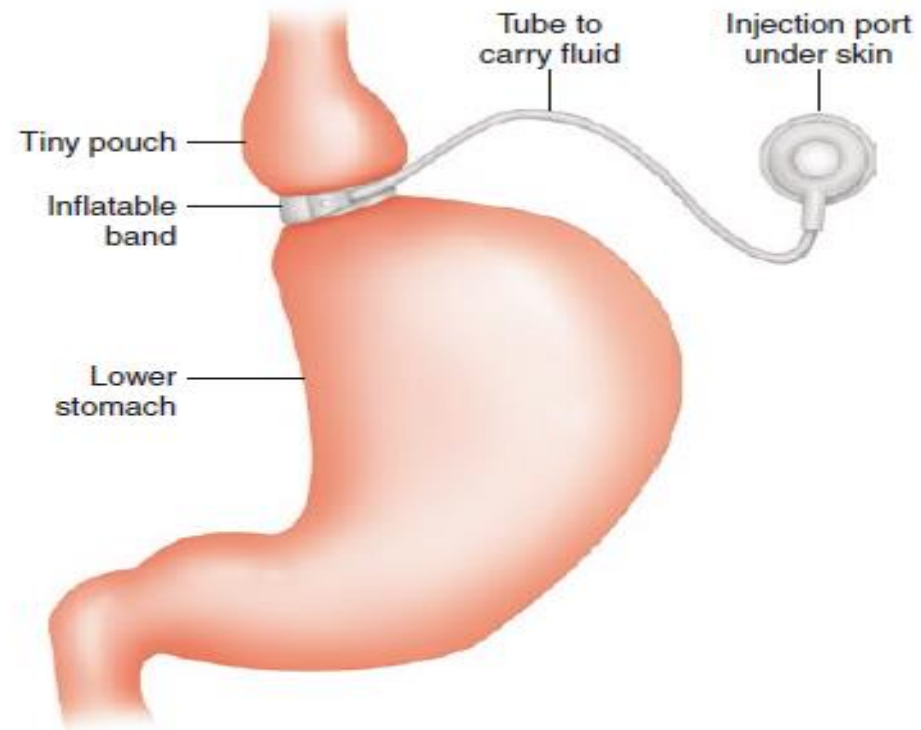
### ج - روش های ترکیبی : ترکیبی از هر دو روش محدود کننده و سوء جذب

- بای پس کلاسیک معده (Gastric Bypass)
- مینی بای پس معده (Mini Gastric Bypass)



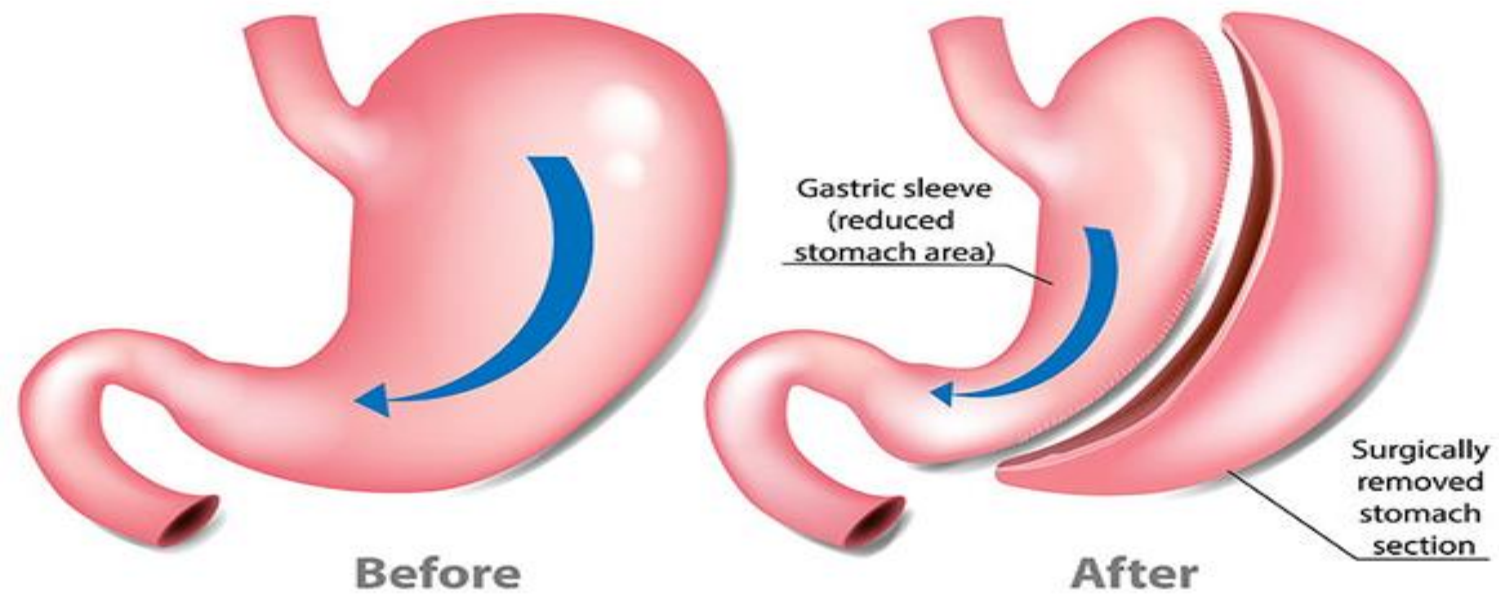
## انواع جراحی های باریاتریک

**Fig. 1.4** Adjustable gastric band, leaving a tiny proximal gastric pouch. A subcutaneous reservoir on the fascia communicates by fine tubing with the hollow band; reservoir injection or withdrawal of saline tightens or loosens the band

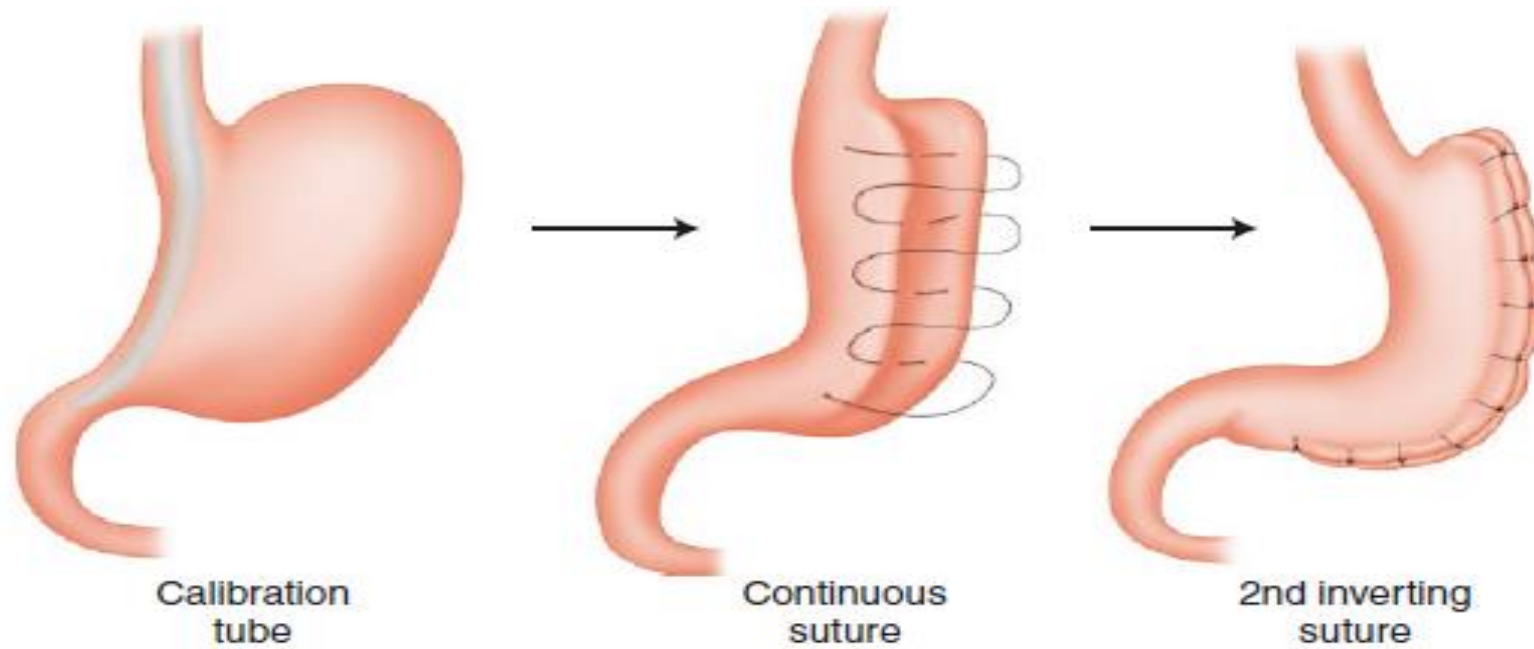


## انواع جراحی های باریاتریک

### SLEEVE GASTRECTOMY

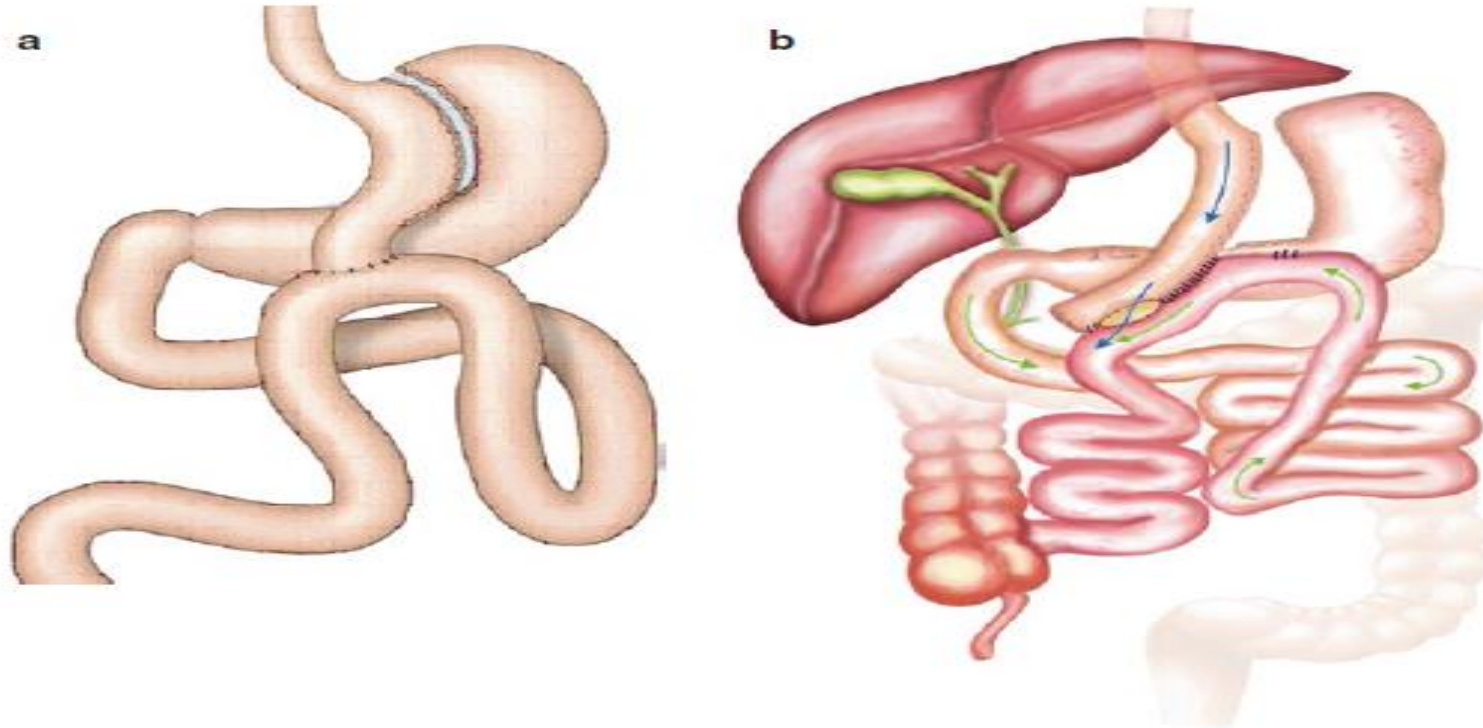


## انواع جراحی های باریاتریک



**Fig. 1.8** Gastric plication. The greater curvature of the stomach is freed, and 2 layers of non-absorbable seromuscular suture are run from 1–2 cm beyond the angle of His to 3–4 cm proximal to the pylorus, against a 32-French oro-gastric tube, decreasing the lumen

## انواع جراحی های باریاتریک

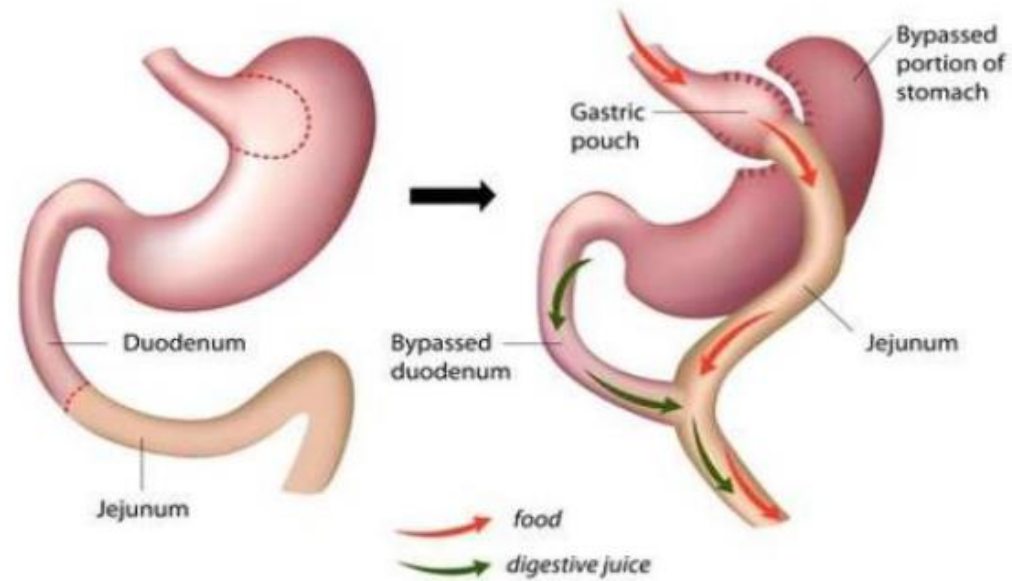


**Fig. 1.10** (a) MGB. A vertical channel starting *below* the crow's foot is stapler-divided proximally going to the left of the angle of His; the long gastric pouch is anastomosed by a wide antecolic gastro-jejunostomy ~200 cm distal to Treitz ligament. (b) OAGB, with a 15–18 cm gastric channel (pouch). A 2.5 cm latero-lateral anastomosis is made between the pouch and antecolic afferent jejunal loop. The afferent loop is suspended above the anastomosis by a continuous suture, which secures the loop to the gastric pouch's staple-line. Apex of the loop is fixed by sutures to the bypassed stomach (diagram by Arturo Valdes Alvarez)

## انواع جراحی های باریاتریک

بایپس کلاسیک:

### Roux-en-Y Gastric Bypass (RYGB)



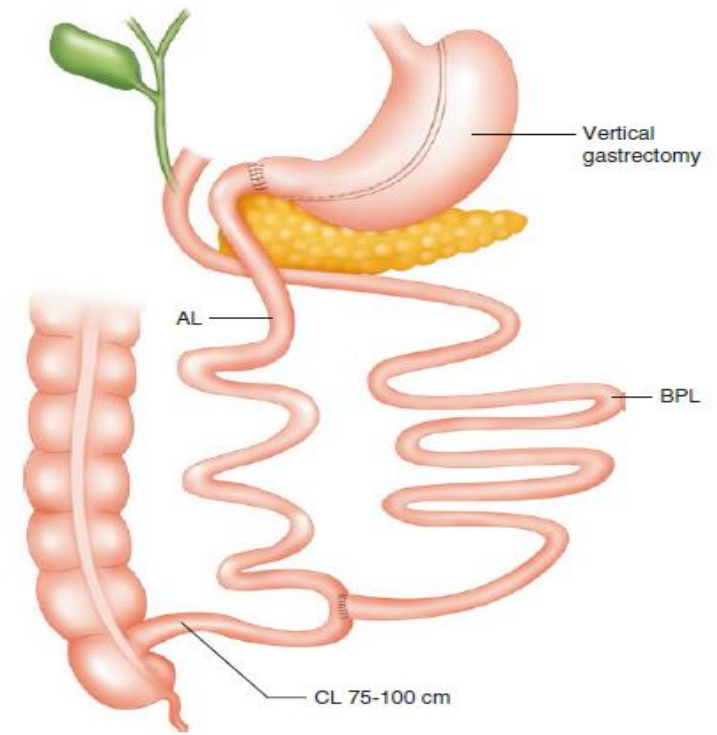
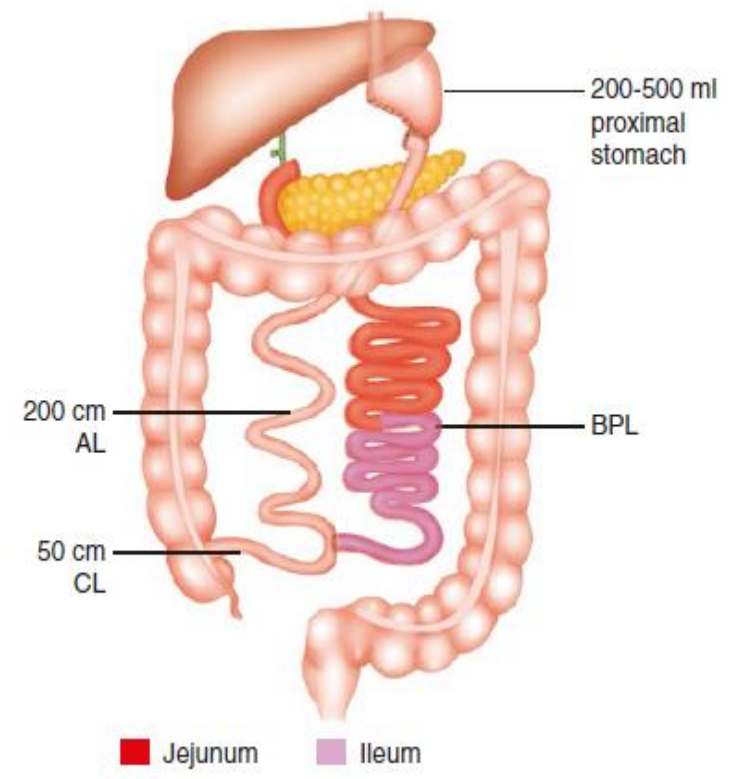
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## انواع جراحی های باریاتریک

**Fig. 1.5** BPD. Distal gastrectomy was performed. Small bowel was divided 250 cm proximal to ileocecal valve, and was anastomosed to the gastric remnant. Biliopancreatic limb (BPL) was anastomosed to side of the distal limb, 50 cm proximal to the ileocecal valve, leaving a 200 cm alimentary limb (AL) and a 50 cm common limb (CL)



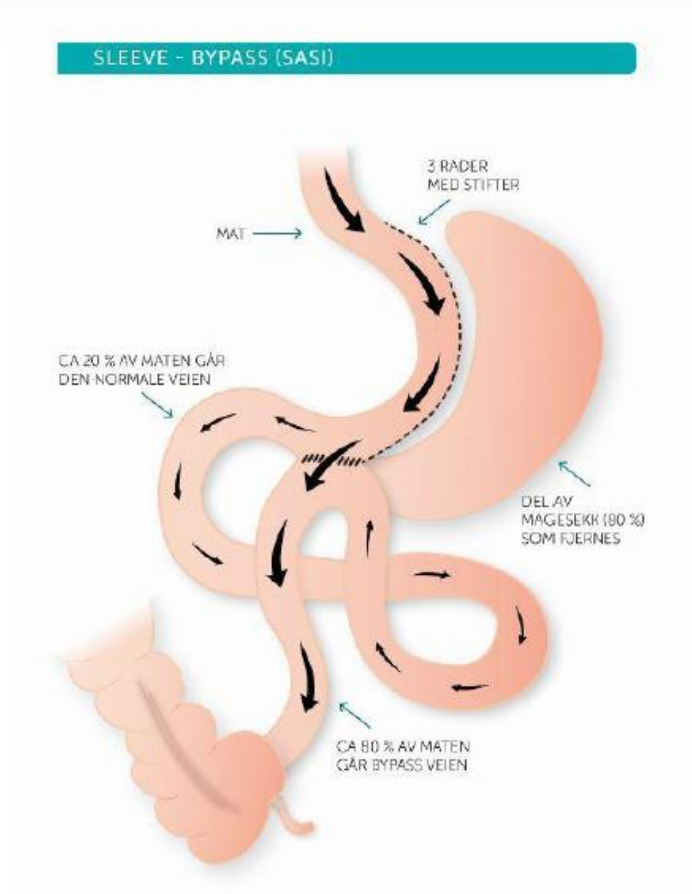
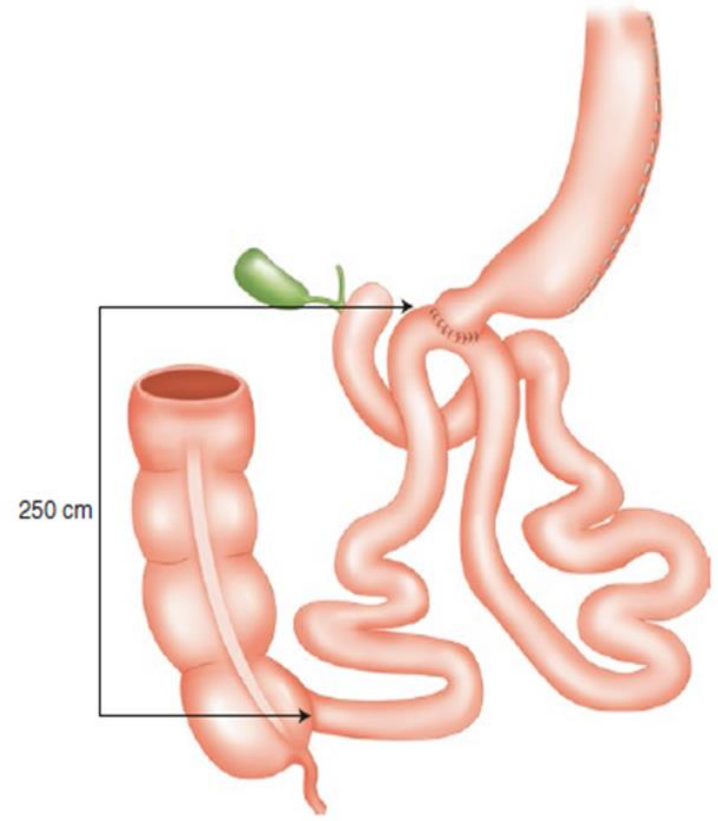
**Fig. 1.6** Duodenal switch. The greater curvature portion of the stomach is excised, leaving a restrictive lesser curvature gastric channel. The small bowel is divided 250 cm proximal to the ileocecal valve, and the alimentary limb (AL) is anastomosed to the divided proximal duodenum. The biliopancreatic limb (BPL) is anastomosed to the side of the AL 75–100 cm proximal to the ileocecal valve, forming the *distal* common limb (CL) where digestion occurs

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## انواع جراحی های باریاتریک

اسلیو-ایلیال بایپس (SASI):



**Fig. 1.9** SADI-S. Sleeve gastrectomy followed by end-to-side single-loop duodeno-ileostomy, with 250 cm between anastomosis and ileocecal valve. Anastomosis performed in antecolic, isoperistaltic fashion

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## انواع جراحی های باریاتریک

Obesity Surgery (2019) 29:3769–3770  
<https://doi.org/10.1007/s11695-019-04016-x>



BRIEF COMMUNICATION



### Single Anastomosis Sleeve-Jejunal Bypass: a New Method of Bariatric/Metabolic Surgery

Abdolreza Pazouki<sup>1,2</sup> · Mohammad Kermansaravi<sup>1,2</sup>

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## انواع جراحی های باریاتریک

### SASJ



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حمایت تغذیه در جراحی های باریاتریک، دکتر خالوئی فرد

- ❖ The decision to recommend weight loss surgery (WLS) for patients with obesity requires a **multidisciplinary team**(MDT):
  - to evaluate the indications for an operation
  - to define and manage comorbidities
  - to provide short- and long-term post-WLS
    - monitoring
    - support
    - Education
  
- ❖ **Core member of the MDT include:**
  - Obesity Physician/Bariatric Surgeon
  - **Dietitian**
  - Psychologist
  - Anesthetist.
  - Additional members(plastic surgeons, nurse specialists, administrators)
  
- ❖ The role of the pre/post surgical MDT is to **assess** and **prepare** patients **medically, nutritionally,** and **psychologically** to:
  - reduce risks of surgery
  - improve surgical outcomes

## اقدامات حمایتی قبل از عمل جراحی چاقی

○ قبل از اینکه افراد بسیار چاق مورد عمل جراحی قرار گیرند ، باید شکست در یک برنامه جامع داشته باشند که شامل:

▪ محدودیت دریافت کالری ( CR )

▪ ورزش

▪ اصلاح سبک زندگی

▪ مشاوره روانی

▪ اثبات همکاری خانواده

○ شکست درمان :

▪ ناتوانی بیمار در کاهش یک سوم وزن بدن

▪ ناتوانی بیمار در کاهش نصف چربی بدن

▪ عدم توانایی در حفظ هر گونه کاهش وزن بدست آمده



Table 1  
**Suggested Preoperative Nutrition Assessment**

Recommended	Suggested	Other considerations
<u>Anthropometrics</u>		
Age, sex, race, accurate height and weight, BMI, excess body weight	Visual inspection of hair, skin, and nails	Waist circumference Other body measurements
<u>Weight history</u>		
Failed weight loss attempts Recent preoperative weight loss attempt (if required by program)	Life events that may have caused weight change	Personal weight loss goals
<u>Medical history</u>		
Current co-morbidities Current medications Vitamin/mineral/herbal supplements Food allergies/intolerances	Past medical history If available: % body fat using bioelectrical impedance; resting metabolic rate (volume of oxygen uptake); respiratory quotient	Observation of body fat distribution Consideration of patients who are athletic or muscular and BMI classifications
<u>Available laboratory values</u>		
<u>Psychological history</u>		
History of eating disorder Current/past psychiatric diagnosis		
<u>Other</u>		
Alcohol/tobacco/drug use Problems with eyesight Problems with dentition Literacy level Language barrier		

### Dietary intake: food/fluid

24-hr recall (weekday/weekend),  
Food frequency record, or  
Food, mood, and activity log (helps identify food group omission or dietary practices that increase nutritional risk)  
Restaurant meal intake  
Disordered eating patterns

Cultural diet influences  
Religious diet restrictions  
Meal preparation skill level  
Craving/trigger foods  
Eats while engaged in other activities

Computerized nutrient analysis  
(if available)  
Food preferences  
Attitudes toward food

### Physical activity

Physical conditions limiting activity  
Current level of activity

Types of activities enjoyed in the past  
Amount of time spent in daily sedentary activities

Activity preference for the future  
Attitude toward physical activity

### Psychosocial

Motivation/reasons for seeking surgical intervention  
Readiness to make behavioral, diet, exercise, and lifestyle changes  
Previous application of above principles listed to demonstrate ability to make lifestyle change  
Willingness to comply with program protocol  
Emotional connection with food  
Stress level and coping mechanisms  
Identify personal barriers to postoperative success

Confidence to maintain weight loss  
Anticipated life changes  
Marital status/children  
Support system  
Work schedule  
Financial constraints  
Referral to appropriate professionals for specialized physical activity instruction and/or mental health evaluation

Attitude toward lifestyle change  
Attitude toward taking life-long vitamin supplementation

## Laboratory Tests before and after Bariatric surgery

**Table 2.** Schedule for clinical and biochemical monitoring

	Pre-operative	1 month	3 months	6 months	12 months	18 months	24 months	Annually
Complete blood count	X	X	X	X	X	X	X	X
LFTs	X	X	X	X	X	X	X	X
Glucose	X	X	X	X	X	X	X	X
Creatinine	X	X	X	X	X	X	X	X
Electrolytes	X	X	X	X	X	X	X	X
Iron/ferritin	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
Vitamin B12	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
Folate	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
Calcium	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
Intact PTH	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
25-D	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
Albumin/prealbumin	X			X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>	X <sup>a</sup>
Vitamin A	X						Optional	Optional
Zinc	X			Optional	Optional		Optional	Optional
Bone mineral density and body composition	X				X <sup>a</sup>		X <sup>a</sup>	X <sup>a</sup>
Vitamin B1			Optional	Optional	Optional	Optional	Optional	Optional

Table 2  
Suggested Preoperative Nutrition Education

Recommended	Suggested	Other considerations
<u>Discuss/include</u>		
<p>Importance of taking personal responsibility for self-care and lifestyle choices</p> <p>Techniques for self-monitoring and keeping daily food journal</p> <p>Preoperative diet preparation (if required by program)</p>	<p>Realistic goal setting</p> <p>Benefits of physical activity</p>	<p>Appropriate monitoring of weight loss</p>
<u>Postoperative intake</u>	<u>Common complaints</u>	<u>Long-term maintenance</u>
<p>Adequate hydration</p> <p>Texture progression</p> <p>Vitamin/mineral supplements</p> <p>Protein supplements</p> <p>Meal planning and spacing</p> <p>Appropriate carbohydrate, protein, and fat intake, and food/fluid choices to maximize safe weight loss, nutrient intake, and tolerance</p> <p>Concepts of intuitive eating</p> <p>Techniques and tips to maximize food and fluid tolerance</p> <p>Possibility of nutrient malabsorption and importance of supplement compliance</p> <p>Possibility of weight regain</p>	<p>Dehydration</p> <p>Nausea/vomiting</p> <p>Anorexia</p> <p>Effects of ketosis</p> <p>Return of hunger</p> <p>Stomal obstruction from food</p> <p>Dumping syndrome</p> <p>Reactive hypoglycemia</p> <p>Constipation</p> <p>Diarrhea/steatorrhea</p> <p>Flatulence/bowel sounds</p> <p>Lactose intolerance</p> <p>Alopecia</p>	<p>Self-monitoring</p> <p>Nutrient dense food choices for disease prevention</p> <p>Restaurants</p> <p>Label reading</p> <p>Healthy cooking techniques</p> <p>Relapse management</p>



## Nutritional Strategies Before Bariatric Surgery

**Table 2** The most common nutritional strategies for prebariatric weight loss

Type of diet	Description
Low-calorie diet (LCD)	Recommended daily calorie intake: 800–1200 kcal/day. Portion control, along with some “regular” food or high-protein supplements. Beneficial dietary plan for diabetic patients [29].
Very low-calorie diet (VLCD)	Recommended daily calorie intake: 500–800 kcal. In order to prevent lean mass loss, the daily amount of protein intake should be carefully adjusted. Careful medical supervision is needed to early diagnosis and management of some probable and usually mild side effects including gallstones, cold intolerance, hair loss, headache, fatigue, dizziness, volume depletion (with electrolyte abnormalities), muscle cramps, and constipation and to prevent unusual serious complications [29].
Liquid low-energy formula diet	A low-calorie or very low-calorie diet which contained powder-based meals. Example: Cambridge Weight Plan that has four powder-based meals, 1 l skimmed milk, 295 g vegetables and 100 g low-fat yogurt per day, with the provision of 1000 kcal/day [30]



## Nutritional Strategies Before Bariatric Surgery

**Table 1** The benefits of prebariatric weight loss

Effect	Outcomes
Increase	Preoperative excess weight loss [9] Post-operative weight loss [10]
Decrease	Preoperative BMI [11, 12] Liver size or volume [12–17] Intrahepatic fat content [14, 15, 17] Visceral adipose tissue (VAT) mass [18] Abdominal wall depth [18] Technical challenges of surgery and conversion rate of operation [15, 18] Operative time [9, 10, 19] Perioperative blood loss [20] Post-operative complication rates [1, 18] Post-operative hospitalization after lap-GBP [21] Anastomotic ulcers in patients treated by LCD, 1 month after lap-GBP [22]
Improvement	Body composition [11] Medical comorbidities <ul style="list-style-type: none"><li>• Obesity-related co-morbidities [14]</li><li>• Systolic and diastolic blood pressure [16]</li><li>• Metabolic profile (fasting glucose, fasting insulin, LDL, and TAG) [16]</li></ul> Access to the gastro-esophageal junction and upper stomach and retraction of the left lobe of the liver without damage to it [12, 15, 17] <ul style="list-style-type: none"><li>• Facilitation of lap-GBP [23] or LRYGBP [16]</li></ul>

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## What Amount of Preoperative Weight Loss Is Needed?

Previous studies showed that a 10% or more significant reduction of weight, 3 kg of fat, or 5% of excess body weight might be associated with a reduction in the liver size and the additional benefit of a shorter operative time.

## What Is the Appropriate Time to Start a Preoperative Weight Loss Diet?

The minimum time required for obtaining the benefits of liver volume reduction or weight loss is 2 weeks with a mean duration of 4 weeks.



## تغذیه پس از عمل جراحی باریاتریک

**Table 8**  
**Current Texture Advancement in Clinical Practice for**  
**Noncomplicated Patients**

Diet phase	Duration (d)
Clear liquid	1–2
Full liquid	10–14
Puree	10–14+
Mechanically altered soft	$\geq 14$
Regular	—

## Nutrition After Bariatric Surgery

Nutritional management plays a vital role in patients undergoing bariatric surgery.

The **objective of short-term post-operative diets** is to meet the nutritional needs of the patients based on their tolerance to food texture.

Primary diets are divided into **three general categories: clear liquid diets, full liquid diets, and soft diets.**

Diet stages after RYGB/SG BPD/DS	Time to begin	Food	Guidelines
1	Immediately after surgery	Gastric bypass clear liquids	<ul style="list-style-type: none"> <li>• Patients should be encouraged to begin fluid intake after swallow test for a leak. If there is no problem, sipping water is allowed.</li> <li>• For the first 2 h after surgery, 15 ml liquid should be eaten every 30 min for the first 2 h, and increase to 15 ml every 15 min for the rest of the day.</li> <li>• Liquids with no calories are allowed, for example, water and light tea. Carbonated liquids or those with caffeine and sugar should not be used.</li> <li>• Using straw should be limited.</li> </ul>
2	Day 2	Water; crystal light; natural diluted fruit juice without sugar; diluted Gatorade; sugar-free jelly and broth.	<ul style="list-style-type: none"> <li>• At days 2–3, patients should consume 30 ml of no carbonated and no sugar liquids every 15 min.</li> <li>• Caffeine should be restricted.</li> <li>• Patients should be encouraged to sip their liquids slowly.</li> <li>• 0.5 cup fruit juice should be diluted with 0.5 cup water.</li> <li>• Using straw should be limited.</li> </ul>
	Day 4	Low or no fat milk; soy milk; almond milk; plain or Greek yogurt; whey; isolated whey or soy protein powder; protein shakes; crystal light; broth; diluted natural fruit or vegetable juice; sugar-free jelly; smooth vegetable soup with no chunks, mixed with 1% or skim milk or water; sugar-free ice pops.	<ul style="list-style-type: none"> <li>• Recommended total fluid intake is 1500–1800 ml per day.</li> <li>• Patients should be encouraged to consume 120–170 ml of liquids every hour.</li> <li>• Daily intake of protein supplement should be limited to 25–30 g per serving (100–200 cal; &lt; 10 g sugar; &lt; 15 g carbohydrates)</li> <li>• Consumption of plain yogurt, with more than 25 g added sugar, should be limited.</li> <li>• Patients should be encouraged to consume salty liquids in moderation.</li> <li>• Carbonated liquids or those with caffeine and sugar should not be used.</li> <li>• Using straw should be limited.</li> <li>• Recommended total fluid intake is 1500–1800 ml per day.</li> <li>• At least 4 cups of water should be included.</li> </ul>
3	Days 14–10 (depending on patient tolerance)	Ground or pureed low-fat meat, poultry and fish; eggs, egg whites or egg substitute; low-fat cheese, cottage cheese; soft tofu; strained soups; well-cooked vegetables; unsweetened applesauce; homemade compote without sugar; canned fruit in water; pureed and soft banana and non-fibrous, pureed of other fruits.	<ul style="list-style-type: none"> <li>• Soft, pureed food should be started.</li> <li>• Patients should be encouraged to consume 3–5 small meals.</li> <li>• Protein-rich foods should be included.</li> <li>• Patients should be encouraged not to drink water with or immediately after meal (no problem to drink 15 min before or 30 min after meal).</li> <li>• As soon as patients can tolerate a 0.5 cup of food at one sitting, daily intake should be limited to 3 small meals and 2 snacks.</li> <li>• Since some patients cannot provide their daily nutritional needs for protein through food at this stage, the use of protein powders should be continued.</li> </ul>





4

Week 4 post-op and beyond

An advance diet based on the patient's tolerance

- Patients should be encouraged to stay well hydrated (at least 1500–1800 ml of liquids per day).
- New foods should be reintroduced separately to determine which foods are intolerable.
- Patients should be encouraged not to drink water with or immediately after meal (no problem to drink 15 min before or 30 min after meal).
- Raw fruits and vegetables should be included slowly due to some problem in tolerating their skin or texture.
- Intake of rice, bread, and pasta should be limited until patients can tolerate protein-rich food comfortably.
- Patients should be informed that as their sense of a hunger increase in following weeks, food intake should increase gradually (considering recommended daily calorie intake).

# Postoperative Diet Progression

❖ The diet progression is gradual. Think about how patient might progress with her/his nine-month old nephew... **(TAKE BABY STEPS)**

❖ **Slow transition from clear liquids to solid foods**

❖ Try new foods one at a time and gradually replace liquid calories



TRY TO AVOID INTAKE

High saturated and trans fats and cholesterol foods  
 High sugar foods  
 Carbonated and/or alcoholic beverages



EAT 3 MAIN MEALS AND 1 OR 2 SNACKS EVERY DAY



CONTROL INTAKE

Servings: 2/day  
 Cereals: rice, pasta: 90 gr\*, breakfast cereals, bread and toast: 30 gr.  
 Legumes: lentils, peas, black and white beans, soybean: 80 gr\*.  
 Tubers: potato, sweet potato: 85 gr\*.



DRINK AT LEAST 6 GLASSES OF WATER A DAY



PREFERENT INTAKE

Servings: 2-3/day of each food group  
 Fruit  
 - low sugar fresh fruit: (melon, water melon, strawberry, grapefruit, apple, orange, etc): 140 gr.  
 - high sugar fresh fruit: (grapes, apricot, banana, cherry, nectarine, medlar, lychee): 70 gr.  
 Vegetable oil (preferably olive oil): 1 teaspoon  
 All types of vegetables 85 gr.



EAT REGULARLY



PREFERENT INTAKE

Servings: 4-6/day  
 Low fat meat: chicken, beef, pork: 60 gr.  
 Fish: blue: 60 gr., white: 85 gr.  
 Low fat or fat free dairy products: hard cheese: 50 gr., soft cheese: 80 gr., milk: 140 gr., yogurt: 115 gr.  
 Legumes: lentils, peas, black and white beans, soybean: 80 gr\*.  
 Eggs: 1 large: 50 gr.  
 \* Cooked weight



PORTION SIZE



DON'T FORGET EVERY DAY

Daily nutritional supplements:  
 Calcium and vitamin D  
 Iron  
 V&M complex  
 Vitamin B12  
 Ensure daily water or non-carbonated, sugar free non-caffeine fluid intake



EAT SLOWLY



\* The pyramid applies to patients whose surgery has been performed at least 1 month ago.

# Nutrition After Bariatric Surgery

## Calorie Goals

The exact calorie intake for better weight loss after bariatric surgery is not known yet and should be defined based on age, sex, and daily activity level.

However, a negative energy balance is vital. Daily calorie intake is estimated from 400 to 500 kcal on the first day post-surgery to 1000 at the end of the first year.

**In the first weeks, calorie intake is usually equal to 500–800 kcal/day, which is gradually increased to 800–1000 kcal/day during 3–12 months.**

Regular nutritional follow-ups help patients to develop healthy eating habits and to meet their nutritional needs instead of focusing on the calorie intake.

Recommendations	UpToDate: postoperative nutritional management [857]	2008 ASMBS Allied Health Nutritional Guidelines [858]
Fluids	Throughout all the diet stages, patients should be counseled to consume adequate fluid to prevent dehydration	N/A
Protein	<p>46 g/d—women 56 g/d—men Protein needs:</p> <ul style="list-style-type: none"> <li>• Should constitute 10%–35% of daily caloric intake</li> <li>• Weight maintenance: .8–1.2 g/kg weight per day</li> <li>• Active weight loss: 1.2 g/kg weight (BPD/DS may require 1.5–2.0 g/kg weight per day)</li> </ul>	Exact needs have yet to be defined
Recommendations	Guidelines for perioperative care in bariatric surgery: ERAS Society Recommendations [568]	Academy of Nutrition and Dietetics Pocket Guide to Bariatric Surgery, second edition [859]
Fluids	>1.5 L daily	<p>48–64 oz/d</p> <ul style="list-style-type: none"> <li>• Women: 48 oz/d</li> <li>• Men: 64 oz/d</li> <li>• 50% goal should be met with clear liquids</li> </ul>
Protein	Should average 60–120 g daily	Guidelines for protein consumption not defined





Recommendations	UpToDate: postoperative nutritional management [857]	2008 ASMBS Allied Health Nutritional Guidelines [858]
Carbohydrates	<ul style="list-style-type: none"> <li>• Early postoperative—50 g/d</li> <li>• As diet intake increases—130 g/d</li> </ul>	N/A
Fat	20%–35% of the daily caloric intake; bulk of the fat intake should be unsaturated fat	N/A
Behavior	<ul style="list-style-type: none"> <li>• Eat slowly</li> <li>• Chew food extensively</li> <li>• Stop eating as soon as reach satiety</li> <li>• Avoid taking food and beverages at the same time</li> <li>• Simple sugars should be limited to &lt;10% of daily caloric intake</li> </ul>	Avoid/delay <ul style="list-style-type: none"> <li>• Concentrated sweets</li> <li>• Carbonated beverages</li> <li>• Fruit juice</li> <li>• High-saturated fat, fried foods</li> <li>• Soft doughy bread, pasta, rice</li> <li>• Tough, dry, red meat</li> <li>• Nuts, popcorn, other fibrous foods</li> <li>• Caffeine</li> <li>• Alcohol</li> </ul>
Recommendations	UpToDate: postoperative nutritional management [857]	2008 ASMBS Allied Health Nutritional Guidelines [858]



Recommendations	Guidelines for perioperative care in bariatric surgery: ERAS Society Recommendations [568]	Academy of Nutrition and Dietetics Pocket Guide to Bariatric Surgery, second edition [859]
Carbohydrates	N/A	N/A
Fat	N/A	N/A
Behavior	<ul style="list-style-type: none"><li>• Multiple small meals each day</li><li>• Chewing food thoroughly without drinking beverages at the same time</li><li>• Consume fluids slowly</li></ul>	<ul style="list-style-type: none"><li>• Practice mindful eating</li><li>• Chew all food until it is smooth</li><li>• Make sure food is soft and moist enough to swallow without sticking</li><li>• Do not drink liquids during meals</li><li>• Wait 30 min after eating before resuming fluid intake</li><li>• Avoid bread, rice, and pasta until able to comfortably consume adequate protein, vegetables, and fruits</li></ul>
Recommendations	Guidelines for perioperative care in bariatric surgery: ERAS Society Recommendations [568]	Academy of Nutrition and Dietetics Pocket Guide to Bariatric Surgery, second edition [859]



Recommendations	UpToDate: postoperative nutritional management [857]	2008 ASMBS Allied Health Nutritional Guidelines [858]
Other	Close monitoring with an RD	Dietician's role is a vital component of the bariatric surgery process Follow-up with RD
Recommendations	Guidelines for perioperative care in bariatric surgery: ERAS Society Recommendations [568]	Academy of Nutrition and Dietetics Pocket Guide to Bariatric Surgery, second edition [859]
Other	Nutritional and meal planning guidance should be provided to patient and family before bariatric surgery and during the postoperative hospital course and reinforced at subsequent outpatient visits Consultation should be provided with a dietician; a protocol-derived staged meal progression, based on the type of surgical procedure, should be followed	RD responsible for the nutrition care of the postsurgery patient and plays an important role in every aspect of care, from preoperative assessment of the patient to long-term follow-up, evaluation, and monitoring



## Deficiencies before surgery

Consequences of obesity and lack of intake due to wrong nutritional habit

Vitamin A  
Vitamin B12  
Vitamin C  
Vitamin D  
Folic acid  
Calcium  
Iron  
Selenium  
Zinc



## Deficiencies after surgery

Nutrients malabsorption and lack of intake due to wrong nutritional habit

Vitamin A  
Vitamin B12  
Vitamin B1  
Vitamin C  
Vitamin D  
Vitamin K1  
Vitamin E  
Folic acid  
Calcium  
Copper  
Iron  
Selenium  
Zinc

## Main risks

Anemia, ataxia, hair loss, hyperoxaluria, osteoporosis, poor wound healing, Wernicke encephalopathy

## Management of bariatric patients

Healthy nutrition, exercise routine follow-ups after surgery specific treatment with dietary supplements

Table 5  
 Suggested Postoperative Vitamin Supplementation

Supplement	AGB	RYGB	BPD/DS	Comment
<p><u>Multivitamin-mineral supplement</u></p> <p>*A high-potency vitamin containing 100% of daily value for at least 2/3 of nutrients</p> <p>Begin with chewable or liquid</p> <p>Progress to whole tablet/capsule as tolerated</p> <p>Avoid time-released supplements</p> <p>Avoid enteric coating</p> <p>Choose a complete formula with at least 18 mg iron, 400 <math>\mu</math>g folic acid, and containing selenium and zinc in each serving</p> <p>Avoid children's formulas that are incomplete</p> <p>May improve gastrointestinal tolerance when taken close to food intake</p> <p>May separate dosage</p> <p>Do not mix multivitamin containing iron with calcium supplement, take at least 2 hr apart</p> <p>Individual brands should be reviewed for absorption rate and bioavailability</p> <p>Specialized bariatric formulations are available</p>	100% of daily value*	200% of daily value*	200% of daily value*	Begin on day 1 after hospital discharge
<p><u>Additional cobalamin (B<sub>12</sub>)</u></p> <p>Available forms include sublingual tablets, liquid drops, mouth spray, or nasal gel/spray</p> <p>Intramuscular injection</p> <p>Oral tablet (crystalline form)</p> <p>Supplementation after AGB and BPD/DS may be required</p>	—	1000 $\mu$ g/mo	—	Begin 0–3 mo after surgery
	—	350–500 $\mu$ g/d	—	



Additional elemental calcium

Choose a brand that contains calcium citrate and vitamin D<sub>3</sub>  
Begin with chewable or liquid  
Progress to whole tablet/capsule as tolerated

Split into 500–600 mg doses; be mindful of serving size on supplement label  
Space doses evenly throughout day  
Suggest a brand that contains magnesium, especially for BPD/DS  
Do not combine calcium with iron containing supplements:  
To maximize absorption  
To minimize gastrointestinal intolerance  
Wait ≥2 h after taking multivitamin or iron supplement  
Promote intake of dairy beverages and/or foods that are significant sources of dietary calcium in addition to recommended supplements, up to 3 servings daily  
Combined dietary and supplemental calcium intake >1700 mg/d may be required to prevent bone loss during rapid weight loss

1500 mg/d

1500– 2000 mg/d

1800– 2400 mg/d

May begin on day 1 after hospital discharge or within 1 mo after surgery

Additional elemental iron (above that provided by mvi)

Recommended for menstruating women and those at risk of anemia (total goal intake = 50-100 mg elemental iron/d)  
Begin with chewable or liquid  
Progress to tablet as tolerated  
Dosage may need to be adjusted based on biochemical markers  
No enteric coating  
Do not mix iron and calcium supplements, take ≥2 h apart  
Avoid excessive intake of tea due to tannin interaction  
Encourage foods rich in heme iron  
Vitamin C may enhance absorption of non-heme iron sources

—

Add a minimum of 18–27 mg/d elemental

Add a minimum of 18–27 mg/d elemental

Begin on day 1 after hospital discharge

Table 5  
Continued

Supplement	AGB	RYGB	BPD/DS	Comment
<u>Fat-soluble vitamins</u>	—	—	10,000 IU of vitamin A	May begin 2–4 weeks after surgery
With all procedures, higher maintenance doses may be required for those with a history of deficiency	—	—	2000 IU of vitamin D	
Water-soluble preparations of fat-soluble vitamins are available	—	—	300 $\mu$ g of vitamin K	
Retinol sources of vitamin A should be used to calculate dosage				
Most supplements contain a high percentage of beta carotene which does not contribute to vitamin A toxicity				
Intake of 2000 IU Vitamin D <sub>3</sub> may be achieved with careful selection of multivitamin and calcium supplements				
No toxic effect known for vitamin K <sub>1</sub> , phytonadione (phyloquinone)				
Vitamin K requirement varies with dietary sources and colonic production				
Caution with vitamin K supplementation for patients receiving coagulation therapy				
Vitamin E deficiency has been suggested but is not prevalent in published studies				
<u>Optional B complex</u>	1 serving/d	1 serving/d	1 serving/d	May begin on day 1 after hospital discharge
B-50 dosage				
Liquid form is available				
Avoid time released tablets				
No known risk of toxicity				
May provide additional prophylaxis against B-vitamin deficiencies, including thiamin, especially for BPD/DS procedures as water-soluble vitamins are absorbed in the proximal jejunum				
Note >1000 mg of supplemental folic acid, provided in combination with multivitamins, could mask B <sub>12</sub> deficiency				

Abbreviations as in Table 4.

Table 4

## Suggested Biochemical Monitoring Tools for Nutrition Status

Vitamin/mineral	Screening	Normal range	Additional laboratory indexes	Critical range	Preoperative deficiency	Postoperative deficiency	Comments
B <sub>1</sub> (thiamin)	Serum thiamin	10–64 ng/mL	↓ RBC transketolase ↑ Pyruvate	Transketolase activity >20% Pyruvate >1 mg/dL	15–29%; more common in African Americans and Hispanics; often associated with poor hydration	Rare, but occurs with RYGB, AGB, and BPD/DS	Serum thiamin responds to dietary supplementation but is poor indicator of total body stores
B <sub>6</sub> (pyridoxine)	PLP	5–24 ng/mL	RBC glutamic pyruvate Oxaloacetic transaminase	PLP <3 ng/mL	Unknown	Rare	Consider with unresolved anemia; diabetes could influence values
B <sub>12</sub> (cobalamin)	Serum B <sub>12</sub>	200–1000 pg/mL	↑ Serum and urinary MMA ↑ Serum tHcy	Serum B <sub>12</sub> <200 pg/mL deficiency <400 pg/mL suboptimal sMMA >0.376 μmol/L μMMA >3.6 μmol/nmol CRT tHcy >13.2 μmol/L	10–13%; may occur with older patients and those taking H <sub>2</sub> blockers and PPIs	Common with RYGB in absence of supplementation, 12–33%	When symptoms are present and B <sub>12</sub> 200–250 pg/mL, MMA and tHcy are useful; serum B <sub>12</sub> may miss 25–30% of deficiency cases
Folate	RBC folate	280–791 ng/mL	Urinary FIGLU Normal serum and urinary MMA ↑ Serum tHcy	RBC folate <305 nmol/L deficiency, <227 nmol/L anemia	Uncommon	Uncommon	Serum folate reflects recent dietary intake rather than folate status; RBC folate is a more sensitive marker Excessive supplementation can mask B <sub>12</sub> deficiency in CBC; neurologic symptoms will persist
Iron	Ferritin	Males: 15–200 ng/mL Females: 12–150 ng/mL	↓ Serum iron ↑ TIBC	Ferritin <20 ng/mL Serum iron <50 μg/dL TIBC >450 μg/dL	9–16% of adult women in general population are deficient	20–49% of patients; common with RYGB for menstruating women (51%), and patients with super obesity (49–52%)	Low Hgb and Hct are consistent with iron deficiency anemia in stage 3 or stage 4 anemia; ferritin is an acute phase reactant and will be elevated with illness and/or inflammation; oral contraceptives reduce blood loss for menstruating females
Vitamin A	Plasma retinol	20–80 μg/dL	RBP	Plasma retinol <10 μg/dL	Uncommon; up to 7% in some studies	Common (50%) with BPD/DS after 1 yr, up to 70% at 4 yr; may occur with RYGB/AGB	Ocular finding may suggest diagnosis

Continued

Vitamin/mineral	Screening	Normal range	Additional laboratory indexes	Critical range	Preoperative deficiency	Postoperative deficiency	Comments
Vitamin D	25(OH)D	25–40 ng/mL	↓ Serum phosphorus ↑ Alkaline phosphatase ↑ Serum PTH ↓ Urinary calcium	Serum 25(OH)D <20 ng/mL suggests deficiency 20–30 ng/mL suggests insufficiency	Common; 60–70%	Common with BPD/DS after 1 yr; may occur with RYGB; prevalence unknown	With deficiency, serum calcium may be low or normal; serum phosphorus may decrease, serum alkaline phosphatase increases; PTH elevated
Vitamin E	Plasma alpha tocopherol	5–20 μg/mL	Plasma lipids	<5 μg/mL	Uncommon	Uncommon	Low plasma alpha tocopherol to plasma lipids (0.8 mg/g total lipid) should be used with hyperlipidemia
Vitamin K	PT	10–13 seconds	↑ DCP ↓ Plasma phylloquinone	Variable	Uncommon	Common with BPD/DS after 1 yr	PT is not a sensitive measure of vitamin K status
Zinc	Plasma zinc	60–130 μg/dL	↓ RBC zinc	Plasma zinc <70 μg/dL	Uncommon, but increased risk of low levels associated with obesity	Common with BPD/DS after 1 yr; may occur with RYGB	Monitor albumin levels and interpret zinc accordingly, albumin is primary binding protein for zinc; no reliable method of determining zinc status is available; plasma zinc is method generally used; studies cited in this report did not adequately describe methods of zinc analysis
Protein	Serum albumin Serum total protein	4–6 g/dL 6–8 g/dL	↓ Serum prealbumin (transferrin)	Albumin <3.0 g/dL Prealbumin <20 mg/dL	Uncommon	Rare, but can occur with RYGB, AGB, and BPD/DS if protein intake is low in total intake or indispensable amino acids	Half-life for prealbumin is 2–4 d and reflects changes in nutritional status sooner than albumin, a nonspecific protein carrier with a half-life of 22 d

RYGB = Roux-en-Y gastric bypass; AGB = adjustable gastric banding; BPD/DS = biliopancreatic diversion/duodenal switch; PLP = pyridoxal-5'-phosphate; RBC = red blood cell; MMA = methylmalonic acid; tHcy = total homocysteine; CRT = creatinine; PPIs = protein pump inhibitors; FIGLU = formiminogluatmic acid; CBC = complete blood count; TIBC = total iron binding capacity; Hgb = hemoglobin; Hct = hematocrit; RPB = retinol binding protein; PTH = parathyroid hormone; 25(OH)D = 25-hydroxyvitamin D; PT = prothrombin time; DCP = des-gamma-carboxypromthrombin.

In general, laboratory values should be reviewed annually or as indicated by clinical presentation. Laboratory normal values vary among laboratory settings and are method dependent. This chart provides a brief summary of monitoring tools. See the Appendix for additional detail and diagnostic tools.

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Vitamin B1 (thiamin)

Presurgery assessment  
Post-surgery assessment

Recommended for all patients. (Grade C, BEL 3)  
Routine screening is recommended in high-risk groups: [Patients with risk factors for thiamin deficiency, females, Blacks, patients not attending a nutritional clinic after surgery, patients with GI symptoms (intractable nausea and vomiting, jejunal dilation, megacolon, or constipation), patients with concomitant medical conditions such as cardiac failure (especially those receiving furosemide)]. (Grade B, BEL2) also, Patients with SBBO. (Grade C, BEL 3)  
\*If signs and symptoms or risk factors are present in post-WLS patients, thiamin status should be assessed at least during the first 6 months, then every 3–6 months until symptoms resolve. (Grade B, BEL2)



Post-surgery recommendation

All post-WLS patients should take at least 12 mg thiamin daily (grade C, BEL3) and preferably a 50-mg dose of thiamin from a B-complex supplement or multivitamin once or twice daily. (Grade D, BEL4)

Post-surgery treatment

Practitioners should treat post-WLS patients with suspected thiamin deficiency before or in the absence of laboratory confirmation of deficiency and monitor and evaluate the resolution of signs and symptoms. (Grade C, BEL3)  
• Oral therapy: 100 mg 2–3 times daily until symptoms resolve. (Grade D, BEL4)  
• IV therapy: 200 mg 3 times daily to 500 mg once or twice daily for 3–5 days, followed by 250 mg/day for 3–5 days or until symptoms resolve, then consider treatment with 100mg/day orally, usually indefinitely or until risk factors have been resolved. (Grade D, BEL4)  
• IM therapy: 250 mg once daily for 3–5 days or 100–250 mg monthly. (Grade C, BEL3)  
\*Simultaneous administration of magnesium, potassium, and phosphorus should be given to patients at risk for refeeding syndrome. (Grade C, BEL3)



Vitamin B12 (cobalamin)

Presurgery assessment

Recommended for all patients (methylmalonic acid is the choice assay). (Grade B, BEL 2)

Post-surgery assessment

Routine post-WLS screening of vitamin B12 status is recommended for patients who have undergone RYGB, SG, or BPD/DS. (Grade B, BEL 2)

More frequent screening (e.g., every 3 months) is recommended in the first post-WLS year, and then at least annually or as clinically indicated for patients who chronically use medications that exacerbate the risk of B12 deficiency: nitrous oxide, neomycin, metformin, colchicine, proton pump inhibitors, and seizure medications. (Grade B, BEL2)

\*Serum B12 may not be adequate to identify B12 deficiency.

Post-surgery recommendation

All post-WLS patients should take vitamin B12 supplementation. (Grade B, BEL2)

- Orally by disintegrating tablet, sublingual, or liquid: 350–500 mg daily
- Nasal spray as directed by the manufacturer
- Parenteral (IM or SQ): 1000 mg monthly.

Post-surgery treatment

- 1000 mg/day to achieve normal levels and then resume dosages recommended to maintain normal levels. (Grade B, BEL2)

Folate (folic acid)

Presurgery assessment

Recommended for all patients. (Grade B, BEL 2)

Post-surgery assessment

Routine post-WLS screening recommended. (Grade B, BEL 2)

Post-surgery recommendation

- 400–800 mg oral folate daily from their multivitamin. (Grade B, BEL2)
- Women of childbearing age should take 800–1000 mg oral folate daily. (Grade B, BEL2)



Iron

Post-surgery treatment	<ul style="list-style-type: none"> <li>• 1000 mg of folate daily to achieve normal levels and then resume the recommended dosage to maintain normal levels. (Grade B, BEL2)</li> <li>* Folate supplementation above 1 mg/day is not recommended in post-WLS patients because of the potential masking of vitamin B12 deficiency. (Grade B, BEL2)</li> </ul>
Presurgery assessment	<p>Recommended for all patients (Ferritin level is used for iron status screening, but not for iron deficiency diagnosing. A combination of tests including, serum iron, serum transferrin saturation, and total iron-binding capacity is recommended for diagnosing iron deficiency). (Grade B, BEL 2)</p>
Post-surgery assessment	<p>Routine post-WLS screening of iron status is recommended within 3 months after surgery, then every 3–6 months until 12 months, and annually for all patients. (Grade B, BEL2)</p>
Post-surgery recommendation	<ul style="list-style-type: none"> <li>• Low-risk patients (males and patients without a history of anemia) for post-WLS iron deficiency should receive at least 18 mg of iron from their multivitamin. (Grade C, BEL3)</li> <li>• Menstruating females and patients who have undergone RYGB, SG, or BPD/DS should take at least 45–60 mg of elemental iron daily (cumulatively, including iron from all vitamin and mineral supplements). (Grade C, BEL3)</li> </ul>
Post-surgery treatment	<p>Oral supplementation should be increased to provide 150–200 mg of elemental iron daily to amounts as high as 300 mg 2–3 times daily. (Grade C, BEL3)</p>

Vitamin D and calcium

Presurgery assessment  
 Post-surgery assessment  
 Post-surgery recommendation

Recommended for all patients (Combination tests: Vit D, 25-OH, serum alkaline phosphatase, PTH, 24-h urinary calcium...). (Grade A, BEL 1)

Routine post-WLS screening recommended. (Grade B, BEL 2)

All post-WLS patients should take calcium supplementation. (Grade C, BEL3)

The appropriate dose of daily calcium from all sources varies by surgical procedure:

- BPD/DS: 1800–2400 mg/day, LAGB, SG, RYGB: 1200–1500 mg/day.

The recommended preventative dose of vitamin D in post-WLS patients should be based on serum vitamin levels:

- Recommended vitamin D3 dose is 3000 IU daily until blood levels of 25(OH)D are greater than sufficient (30 ng/ml). (Grade D, BEL4)



Post-surgery treatment

Vitamin D levels must be repleted if deficient or insufficient to normalize calcium. (Grade C, BEL3)

All post-WLS patients with vitamin D deficiency or insufficiency should be repleted with the following doses:

- VitaminD3 at least 3000 IU/day and as high as 6000 IU/day, or 50,000 IU vitamin D2 1–3 times weekly. (Grade A, BEL1)
- VitaminD3 is recommended as a more potent treatment than vitamin D2 when comparing frequency and amount needed for repletion. However, both forms can be efficacious, depending on the dosing regimen. (Grade A, BEL1)
- The recommendations for repletion of calcium deficiency vary by surgical procedure (Grade C, BEL3): BPD/DS: 1800–2400 mg/day calcium, LAGB, SG, RYGB: 1200–1500 mg/day calcium.

Vitamins A, E, and K

Presurgery assessment  
 Post-surgery assessment

Recommended for all patients (Use physical signs and symptoms and labs for Vit A deficiency: Retinol-binding protein and ↓plasma retinol, Vit E deficiency: ↓plasma α-tocopherol and Vit K deficiency: ↑DCP). (Grade C, BEL 3)

Post-WLS patients should be screened for vitamin A deficiency within the first post-operative year, particularly those who have undergone BPD/DS, regardless of symptoms; in addition, vitamin A should be measured in patients who have undergone RYGB and BPD/DS, particularly



Post-surgery recommendation

in those with evidence of protein-calorie malnutrition.

(Grade B, BEL2)

Vitamin E and K deficiencies are uncommon after WLS, symptomatic patients should be screened. (Grade B, BEL2)

Post-WLS patients should take vitamins A, E, and K, with dosage based on the type of procedure:

- LAGB: vitamin A 5000 IU/day and vitamin K 90–120 µg/day, (Grade C, BEL3)
- RYGB and SG: Vitamin A 5000–10,000 IU/day and vitamin K 90–120 µg/day, (Grade D, BEL4)
- DS: vitamin A 10,000 IU/day and vitamin K 300 µg/day, (Grade B, BEL2)
- LAGB, SG, RYGB, BPD/DS: vitamin E 15 mg/day. (Grade D, BEL4)

\*Higher maintenance doses of fat-soluble vitamins may be required for post-WLS patients with a previous history of deficiency in vitamin A, E, or K. (Grade D, BEL4)

\*Special attention should be paid to post WLS supplementation of vitamin A and K in pregnant women. (Grade D, BEL3)

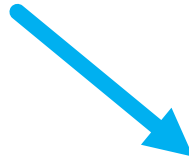
Post-surgery treatment

Vitamin A

- Vitamin A deficiency without corneal changes: a dose of vitamin A 10,000–25,000 IU/day should be administered orally until clinical improvement is evident (1–2 weeks). (Grade D, BEL4)
- With corneal changes: a dose of vitamin A 50,000–100,000 IU should be administered IM for 3 days, followed by 50,000 IU/day IM for 2 weeks (Grade D, BEL4)
- \*Patients should also be evaluated for concurrent iron and copper deficiencies because these can impair the resolution of vitamin A deficiency. (Grade D, BEL4)

Vitamin E

\*The optimal therapeutic dose of vitamin E in post-WLS patients has not been clearly defined. There is potential for antioxidant benefits of vitamin to be achieved with supplements of 100–400 IU/day. This recommendation is higher than the amount typically found in a multivitamin; thus, additional vitamin E supplementation may be required for repletion. (Grade D, BEL4)



## Zinc

### Presurgery assessment

#### Vitamin K

- For post-WLS patients with acute malabsorption, a parenteral dose of 10 mg vitamin K is recommended. (Grade D, BEL4)
- For post-WLS patients with chronic malabsorption, the recommended dosage of vitamin K is either 1–2 mg/day orally or 1–2 mg/week parenterally. (Grade D, BEL4)

Recommended before RYGB or BPD/DS (use physical signs and symptoms and labs: ↓serum or urinary zinc or RBC zinc). (Grade D, BEL 3)

\*Zinc assays in pre-WLS patients should be interpreted because patients with obesity have lower serum zinc levels and lower concentrations of zinc in plasma and erythrocytes than leaner patients. Thus, depletion of zinc is indicated when signs and symptoms are evident, and zinc assays are severely low. (Grade C, BEL3)

### Post-surgery assessment

Screening is recommended at least annually for zinc deficiency in Post-RYGB and post-BPD/DS patients (Serum and plasma zinc are the most appropriate biomarkers for zinc screening of post-WLS patients). (Grade C, BEL3).

\*Zinc should be evaluated in all post-WLS patients when the patient is symptomatic for iron deficiency anemia but



	screening results for iron deficiency anemia is negative. (Grade C, BEL3)
	*Post-WLS patients who have chronic diarrhea should be evaluated for zinc deficiency. (Grade D, BEL4)
Post-surgery recommendation	All post-WLS patients should take > RDA zinc, with dosage based on the type of procedure: <ul style="list-style-type: none"> <li>• BPD/DS: Multivitamin with minerals containing 200% of the RDA (16–22 mg/day)</li> <li>• RYGB: Multivitamin with minerals containing 100–200% of the RDA (8–22 mg/day)</li> <li>• SG/LAGB: Multivitamin with minerals containing 100% of the RDA (8–11 mg/day)</li> </ul> *To minimize the risk of copper deficiency in post-WLS patients, it is recommended that the supplementation protocol contain a ratio of 8–15 mg of supplemental zinc per 1 mg of copper. (Grade C, BEL3)
Post-surgery treatment	There is insufficient evidence to make a dose-related recommendation for repletion. The previous recommendation of 60 mg elemental zinc orally twice a day needs to be reevaluated in light of emerging research that this dose may be inappropriate. *Zinc status should be routinely monitored using consistent parameters throughout treatment. (Grade C, BEL3)
Presurgery assessment	Recommended before RYGB or BPD/ DS (Serum copper and ceruloplasmin are recommended, but they are acute phase reactants, so erythrocyte superoxide dismutase is preferred assay if available). (Grade D, BEL 4)
Post-surgery assessment	Routine screening is recommended at least annually after RYGB or BPD/ DS (serum copper and ceruloplasmin). (Grade C, BEL4)



Copper



## Copper

### Presurgery assessment

Recommended before RYGB or BPD/ DS (Serum copper and ceruloplasmin are recommended, but they are acute phase reactants, so erythrocyte superoxide dismutase is preferred assay if available). (Grade D, BEL 4)

### Post-surgery assessment

Routine screening is recommended at least annually after RYGB or BPD/ DS (serum copper and ceruloplasmin). (Grade C, BEL4)

### Post-surgery recommendation

All post-WLS patients should take > RDA copper as part of routine multivitamin and mineral supplementation:

- BPD/DS or RYGB: 200% of the RDA (2 mg/day), SG or LAGB: 100% of the RDA (1 mg/day).

\*In post-WLS patients, supplementation with 1 mg copper is recommended for every 8–15 mg of elemental zinc to prevent copper deficiency.

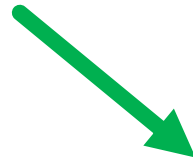
\*In post-WLS patients, copper gluconate or sulfate is recommended. (Grade C, BEL3)

### Post-surgery treatment

The recommended regimen for repletion of copper will vary with the severity of the deficiency:

- Mild to moderate deficiency (including low hematologic indices): treat with 3–8 mg/day oral copper gluconate or sulfate until indices return to normal,
- Severe deficiency: 2–4 mg/day intravenous copper can be initiated for 6 days or until serum levels return to normal and neurologic symptoms resolve,

\*Once copper levels are normal: monitor copper levels every 3 months. (Grade C, BEL3)





پوهنځی جامع

# تنظیم اختلالات آب و الکترولیت و اسید - باز

ویژه متخصصان تغذیه

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با تشکر از توجه شما



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