

# Direct Oral Anticoagulants

## Use in the Setting of Bariatric Surgery and Feeding Tubes

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### DOAC Absorption

DOAC <sup>1-3, 6</sup>	Absorption Location	Notes
<b>Apixaban</b>	Primarily small intestine with some gastric absorption and pH independent absorption in proximal colon*	pH independent absorption *Varying degrees of absorption reported at the different absorption sites per different references
<b>Dabigatran</b>	Lower stomach and duodenum	Prodrug requires acidic environment for absorption (formulated with tartaric acid) <b>20% reduction</b> was seen when given with antacids, however this is thought to be clinically insignificant
<b>Edoxaban</b>	Proximal small intestine	pH dependent solubility
<b>Rivaroxaban</b>	Primarily stomach with reduced absorption in the proximal and small intestine	<b>20mg</b> and <b>15mg</b> tablets must be taken with a sufficient caloric intake; following bariatric surgery, most patients must adhere to a caloric restriction

### Bariatric Surgery

#### Types of Bariatric Surgery

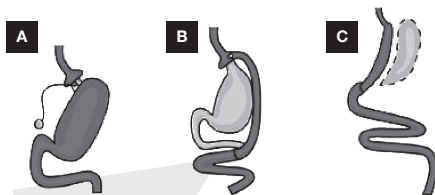


Image Credit: Walter Porjes, M.D. FACS  
<https://www.news-medical.net/health/Bariatric-Surgery-Types.aspx>

- A Adjustable gastric banding (AGB):**  
Adjustable silicone band placed around stomach to create a smaller pouch.
- B Roux-en-Y gastric bypass (RYGB):**  
Stomach stapled to form gastric pouch that connects to distal jejunum, excluding the duodenum and proximal jejunum.
- C Gastrectomy (partial/sleeve):**  
Sleeve gastrectomy results in longitudinal resection of 80% of stomach.
- D Colectomy:**  
Surgical removal of all or part of the colon. (visual not provided)

#### Potential impact of surgical intervention on absorption

	Apixaban	Dabi	Edoxaban	Riva
A	UA	PR	PR	PR
B	PR	PR	PR	PR
C	UA	PR	PR	PR
D	PR	UA	UA	UA

PR Possibly Reduced UA Unlikely Affected

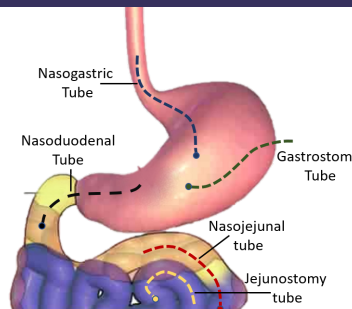
### Feeding Tubes

**Apixaban:** bioavailability is also reduced if administered distal to the stomach. It is recommended to avoid in conjunction with food. Can be given in 60ml D5W. Flushing tube is also preferable.<sup>5</sup> Enteral apixaban is more impacted in presence of nutritional supplementation compared to enteral rivaroxaban.<sup>5</sup>

**Dabigatran:** must be taken orally and should not be administered through an enteral feeding tube.<sup>5</sup>

**Edoxaban:** no studies have been conducted to assess edoxaban use in enteral administration therefore it should be taken as an intact tablet.<sup>5</sup>

**Rivaroxaban:** bioavailability is reduced if administered distal to the stomach. It is recommended to flush tubing prior to and after administration. Can be given in 50mL sterile water, applesauce, or juice.<sup>5</sup>



Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014".  
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### Take Home Points

- There is minimal evidence regarding the use of DOACs in patients with a history of bariatric surgery. 2021 ISTH guidelines specifically address DOAC use following bariatric surgery for treatment/prevention of VTE and recommend treatment with a parenteral anticoagulant in the early/acute setting, followed by a switch to VKA or DOAC in the stable post-acute phase.
- Rivaroxaban should be used with extra caution due to the caloric restrictions associated with gastric bypass, as well as reduction in plasma levels as seen in observational studies.
- If a patient is unable or unwilling to use warfarin, it is important to consider type of bariatric surgery, location of DOAC absorption, pH dependent/independent solubility, transporter mechanisms and to conduct shared decision making prior to initiating DOAC therapy.
- Dabigatran and edoxaban are not recommended for administration via enteral feeding tubes. Rivaroxaban and apixaban can be administered via enteral feeding tubes if terminated in the stomach (nasogastric or gastric tubes).

#### Contributors:

Candace Bryant, PharmD, BCPS; Nilam Naik, PharmD, BCPS; Tennessee Valley Health System Veterans Affairs

### Notes

- Bariatric surgery results in weight loss by reducing stomach volume (which results in a more alkaline pH) and/or reducing effective intestinal surface area which results in malabsorption.
- ALL DOACs are substrates of P-gp. Apixaban and rivaroxaban are substrates of CYP3A4.
- Pgp concentration is lowest in the duodenum and highest in the distal ileum and colon. Bypassing the proximal portions of the GIT (RYGB) could lead to decreased drug absorption due to increased efflux of DOAC back into the gut lumen.
- CYP3A4 is located along the entire small intestine with slightly increased expression from the duodenum to the middle section of the jejunum with gradually reduced expression in the distal jejunum and ileum. Bypassing the proximal segments (RYGB) of the GIT could result in a significant increase in oral bioavailability of substrates due to decreased metabolism.

### 2021 ISTH Guidance<sup>7</sup>

• Data suggests DOACs may be appropriate to prescribe after at least 6–12 months following bariatric surgery. In the early/acute setting after bariatric surgery, consider alterations in the gastrointestinal tract that may lead to malabsorption and altered and reduced oral intake. A cautious approach would include early treatment with a parenteral agent followed by a switch to VKA or DOAC in the stable postacute phase.

• We suggest not to use DOACs for treatment or prevention of VTE in the acute setting after bariatric surgery (concerns of decreased absorption). Instead, initiate patients on parenteral anticoagulation.

• Switching to VKA or DOACs may be considered after at least 4 weeks of parenteral treatment. Suggest obtaining a DOAC trough level to check for drug absorption and bioavailability.

### References

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