

Direct Oral Anticoagulants

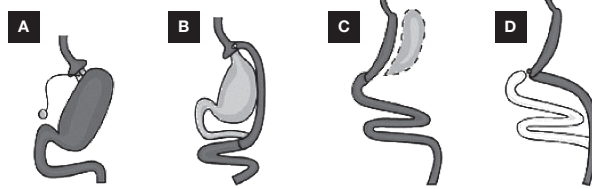
Use in the Setting of Bariatric Surgery and Feeding Tubes

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Bariatric Surgery

FIGURE 1 – Types of Bariatric Surgery



- 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 or total):**
Sleeve gastrectomy results in longitudinal resection of 80% of stomach.
- D. Biliopancreatic diversion with duodenal switch (BPD-DS):**
Gastric pouch reattached more distally to terminal ileum resulting in considerable reduction in absorptive surface and more significant malabsorption.

TABLE 1 – DOAC Absorption Locations

DOAC ¹⁻³	Absorption Location	Notes
Apixaban	55% in distal small bowel and some proximal colon; some gastric and proximal small intestine	pH independent absorption
Dabigatran	Lower stomach and duodenum	Prodrug requires acidic environment for absorption (formulated with tartaric acid) *20% reduction was seen when given with antacids, however this is thought to be clinically insignificant.
Edoxaban	Proximal small intestine	pH dependent solubility
Rivaroxaban	Primarily stomach with reduced absorption in the proximal and small intestine	20mg and 15mg tablets must be taken with a sufficient caloric intake; following bariatric surgery, most patients must adhere to a caloric restriction

Surgical Intervention¹⁻³

	DOAC			
	Apixaban	Dabi	Edoxaban	Riva
Total and Partial Gastrectomy	PR	PR	PR	PR
RYGB	PR	PR	PR	PR
Distal Resection and SBS	PR	PR	UA	UA
Colectomy	PR	UA	UA	UA

PR Possibly Reduced UA Unlikely Affected

Take Home Points

- A.** There is minimal evidence regarding the use of DOACs in patients with a history of bariatric surgery. **Thus, warfarin remains the preferred oral anticoagulant** in this patient population as effectiveness can be measured through INR monitoring.¹⁻²
- B.** 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.³
- C.** 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.
- D.** 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).

References:

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(DOACs) NOTES

- DOACs are absorbed at various locations throughout the gastrointestinal tract. (See Table 1)
- 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.
- There is very little evidence regarding safety and efficacy of DOACs in patients with a history of bariatric surgery or requiring DOAC administration via a feeding tube.
- This document was compiled utilizing current literature incorporating case reports, package inserts, and pharmacokinetic studies as no current randomized controlled trials are available. As always, clinical judgment and a shared decision making approach should be utilized.

Transporter Considerations¹

P-gp concentration is lowest in the duodenum and highest in the distal ileum and colon. Bypassing the proximal portions of the GIT (RYGB, BPD-DS) 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, BPD-DS) of the GIT could result in a **significant increase in oral bioavailability of substrates** due to decreased metabolism.

ALL DOACs are substrates of P-gp. Apixaban and rivaroxaban are substrates of CYP3A4.

Feeding Tubes Examples

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.⁵ Enteral Apixaban is more impacted in presence of nutritional supplementation compared to enteral Rivaroxaban.⁵

Dabigatran: must be taken orally and should not be administered through an enteral feeding tube.⁵

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

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.⁵