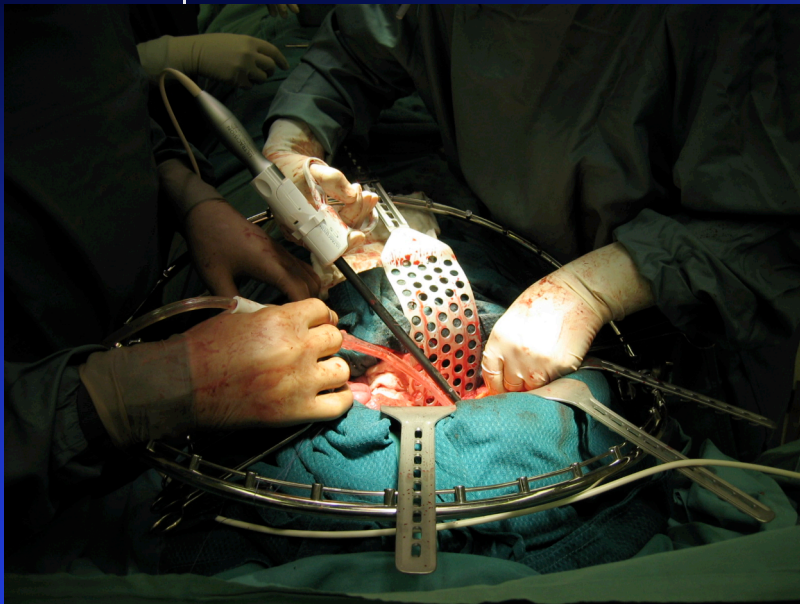


Delayed Gastric Emptying After PPPD Resection (prevent it, fix it or forget it ?)



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HPB Surgeon
Alfred and Western Hospitals



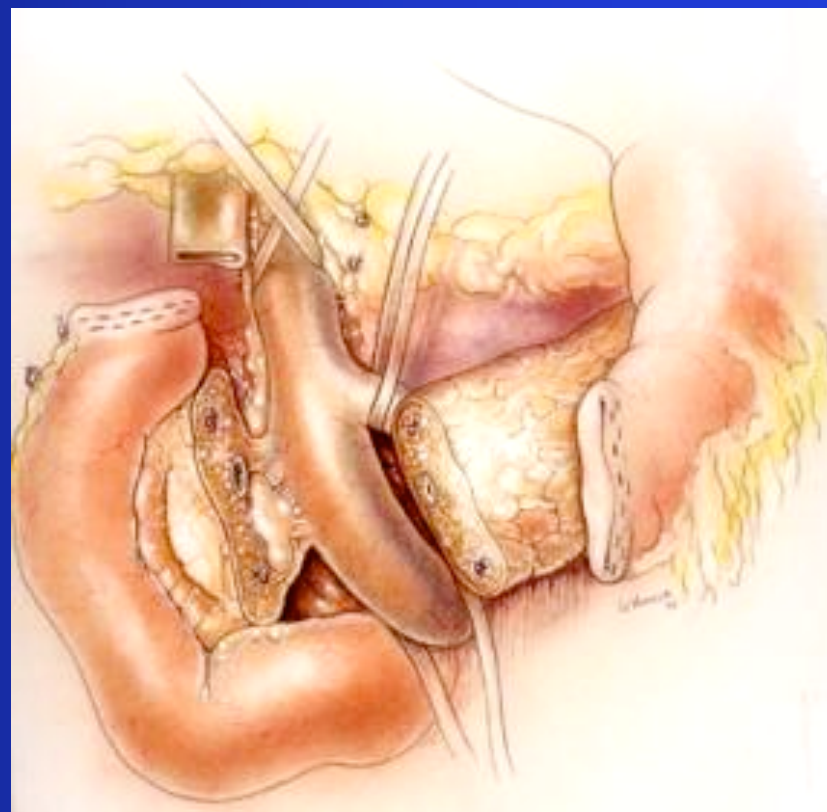
Background

- DGE first described 1985 - 75%
 - **Warshaw et al. SGO 1985**
- Reported consistently around 25%
- Self limiting, not life threatening
- Patient discomfort, anxiety (surgeon too) and prolonged LOS

Study	Year	n	DGE
Itani et al ^{12*}	1986	252	76 (30%)
Roder et al ⁷	1992	48	9 (19%)
Patel et al ⁵	1995	15	9 (61%)
Mosca et al ¹¹	1997	72	14 (19%)
Yeo et al ¹³	1997	650	123 (19%)
Lin and Lin ¹⁰	1999	16	6 (37%)
Di Carlo et al ⁹	1999	74	9 (14%)
Fabre et al ¹⁴	1999	88	36 (41%)
Gouma et al ^{15*}	2000	151	31 (21%)
Jiminez et al ⁶	2000	39	13 (33%)
Büchler et al ⁸	2000	133	27 (20%)
Total		1538	353 (23%)

Pathogenesis

- Damage to nerves of Latarget
- Ischaemia of pylorus or antrum
- Drop in motilin levels 2^o loss of duodenum
- Gastric atony without duodenal pacemaker
- Gastric dysrhythmia 2^o abscess
- Pylorus preservation
- Detail of reconstruction
- Pylorospasm
- Placement of gastrostomy
- Length of duodenum
- Malnutrition, diabetes, adhesions
- Preoperative cholangitis





Definitions

- Delayed gastric emptying in the absence of mechanical obstruction
 - Regular diet by day 10 (or day 14)
 - Liquid diet by day 7
 - NG tube required for 7 (or 10 days)
 - NG volumes >500mls/day for >5 days
 - NG volumes >300mls/day for >10 days
 - With or without vomiting
 - Reinsertion of NG tube
- Frey - Comments Arch Surg 1995
 - “...if we use 5 days as our standard, we could have almost 95% DGE. If we went out to 20 days...it would probably be about 5%.”
- Riediger et al. J Gastrointest Surg 2003
 - 204 pts, PPPD, 3 def'n, DGE 14.7%, 6.4% and 5.6%



Technical Considerations

- PPPD vs Whipple's
- Reconstruction Details
 - Retro(supra)colic, retromesenteric, BI/BII
- Abdominal Complications
- Pylorospasm

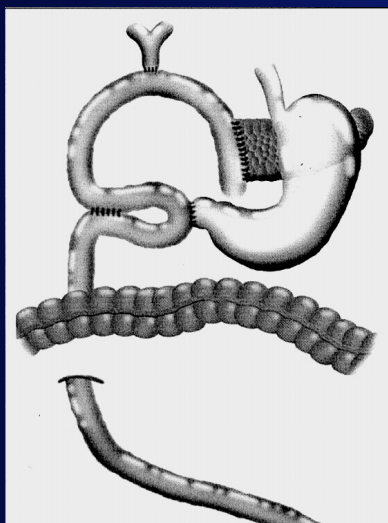
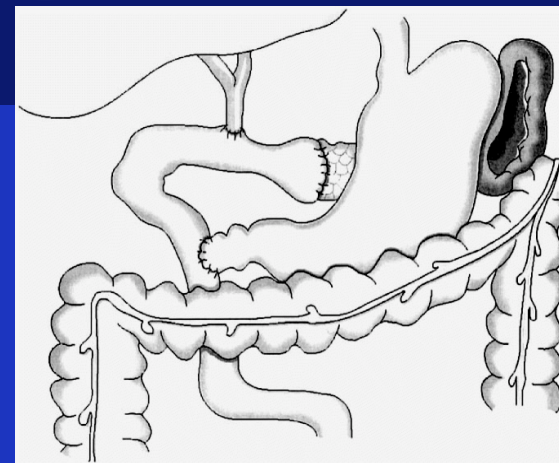


Whipple's vs PPPD

- No difference incidence of DGE - case series
 - Grace et al. Am J Surg 1986
 - Crist et al. AnnSurg 1987
 - McAfee et al. Surgery 1989
 - Kairalouma et al. HPB Surg 1990
 - Klinkenbijnl et al. Ann Surg 1992
 - van Berge Henegouwen et al. J Am Coll Surg 1997
 - Horstman et al. Pancreas 2004
- Randomised Studies
 - Lin et al. BJS 1999. 31 pts - **YES**
 - Seiler, Buchler et al. BJS 2005. 214 pts - NO
 - Tran et al. Ann Surg 2004. Multicent, 170 pts - NO

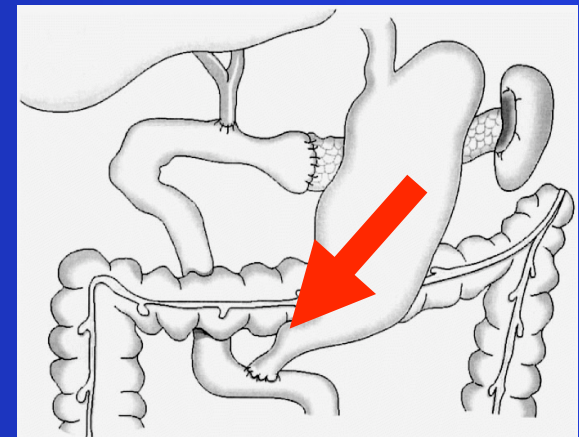
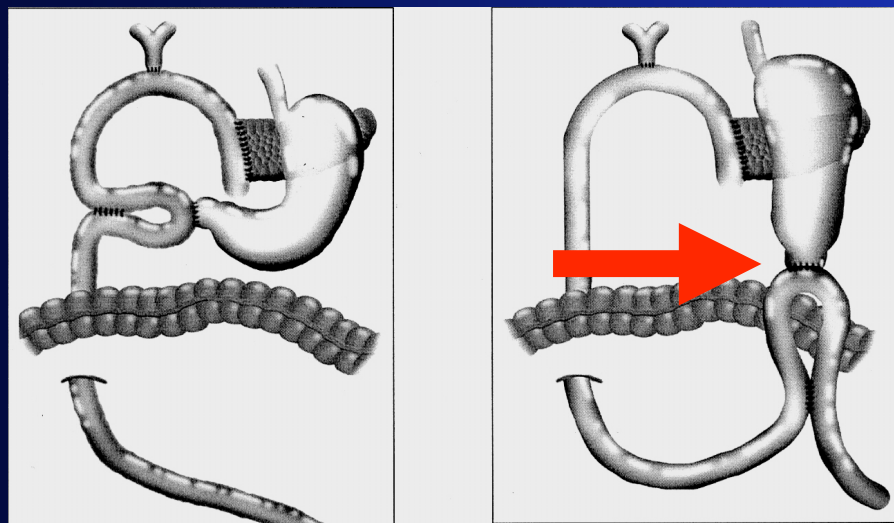
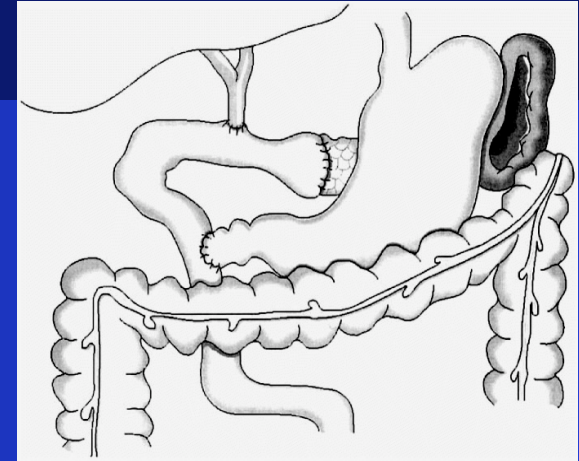
Ante/Retro Colic

- Retrocolic (supracolic) may
 - cause angulation or torsion
 - Exposes anastomosis to sepsis
- Retrocolic higher DGE
 - Kurosaki et al. HepatoGastro 2005 (74% vs 8%)
 - Sugiyama et al. Am J Surg 2004 (72% vs 8%)
 - Horstman et al. Lang Arch Surg 1999 (25% vs 12 %)



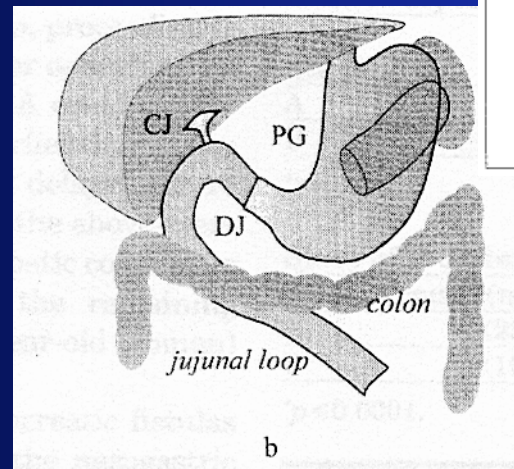
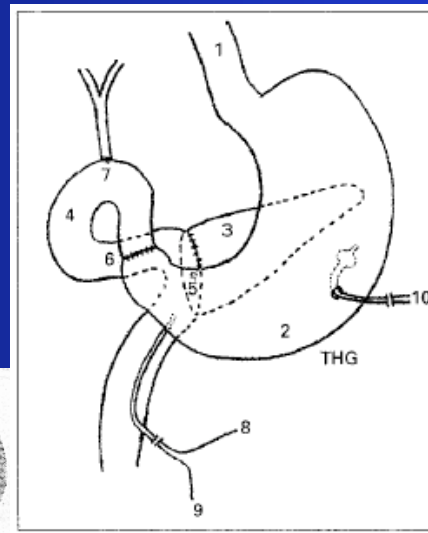
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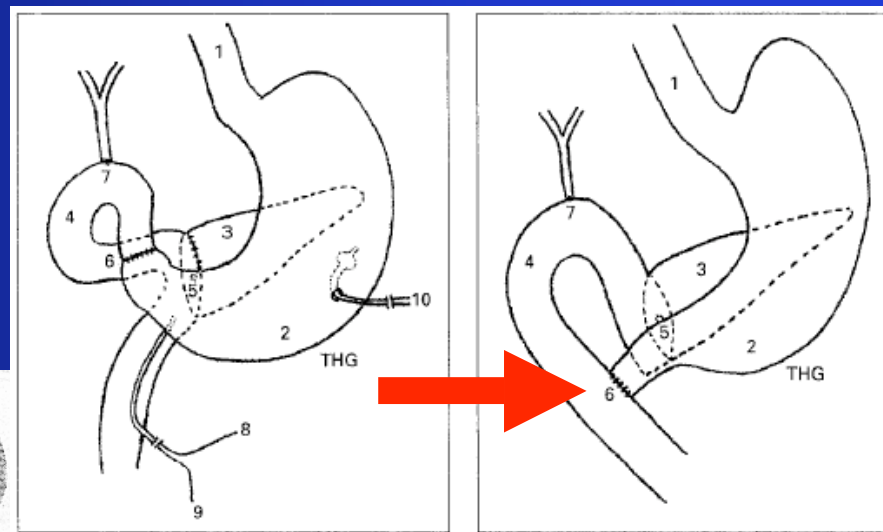
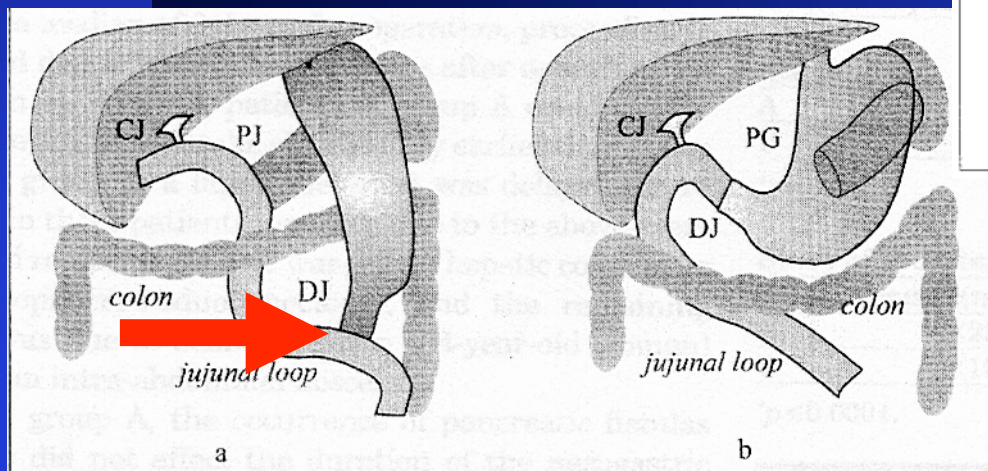
Bilroth I vs II

- Less DGE with BII
 - Goei et al. Dig Surg 2001 (76% vs 32%)
 - Ueno et al. HepatoGastro 1995



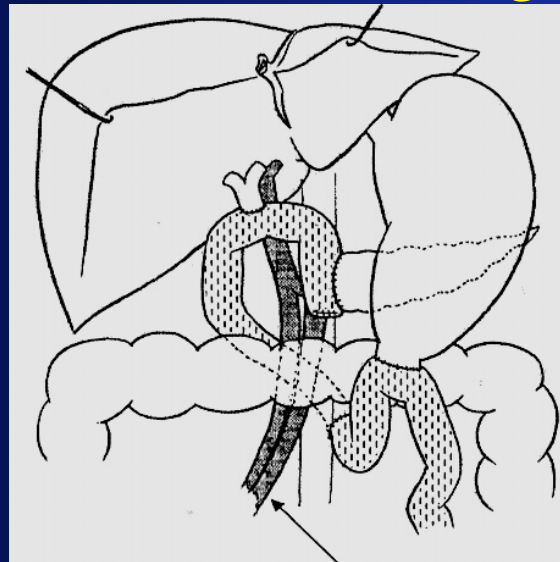
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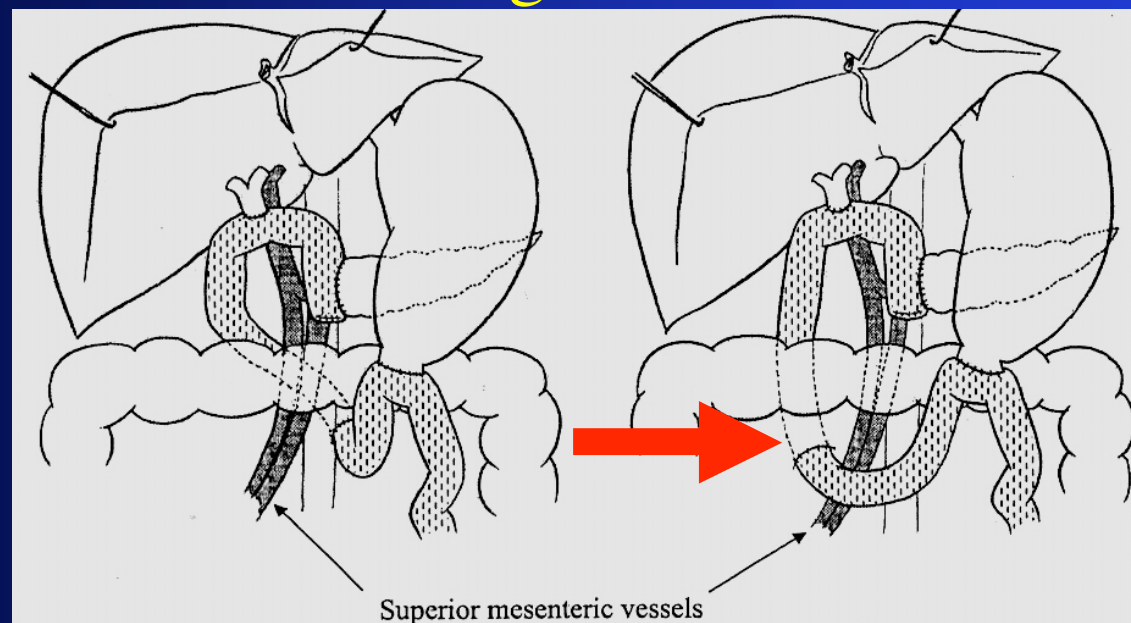
Retro/Ante Mesenteric

- **Park et al. J Am Coll Surg 2003**
 - 150pts, PPPD, overall 24% DGE
 - ↑DGE with retromesenteric (32% vs 7%)
 - ?venous congestion → compromise peristalsis
- **Butler et al. Can J Surg 2004**



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Abdominal Complications

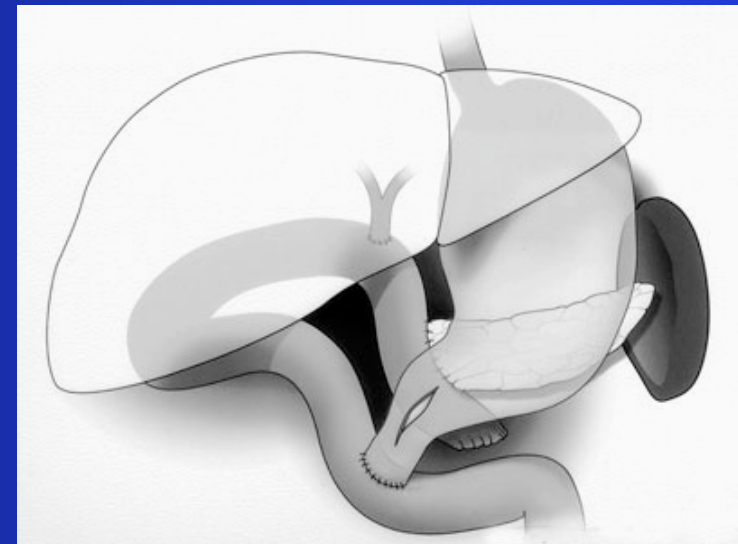
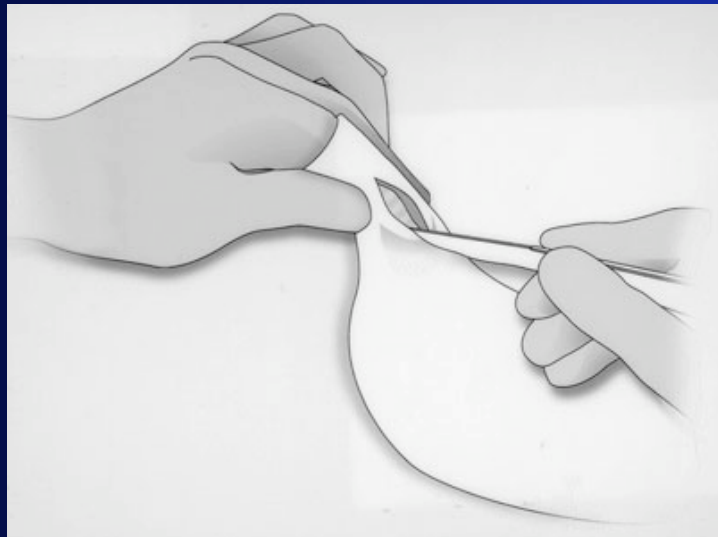
- Significantly higher incidence of DGE
 - Braasch et al. World J Surg 1984
 - Van Berge Henegouwen et al. J Am Coll Surg 1997
 - Horstman et al. Lang Arch Surg 1999 (30% vs 3%)
 - Park et al. J Am Coll Surg 2003 (41% vs 9%)
 - Riediger et al. J Gastrointest Surg 2003 (35% vs 2%)
 - Tran et al. Ann Surg 2004
 - Horstman et al. Pancreas 2004 (32% vs 1%)
- Sohn et al. J Gastrointest Surg 2003
 - 129 pts comp'n, radiol intervention, DGE 5%
 - 932 pts no interventions(complications) DGE 10%
 - No sig difference



Pylorospasm



- **Kim et al. Ann Surg Oncol 2005**
 - 47 pts, PPPD with Ramstedt-type pyloromyotomy
 - Compared to pre technique cohort - DGE 25%
 - This study 2.2%
 - R/o NG tube day 3 in 93% and diet day 4 in 95%
 - Pylorospasm 2° to vagal de-inervation of pylorus
 - ?counter productive to pylorus preservation





Non Technical Considerations

- Enteral Nutrition
- Drugs
 - Octreotide
 - Erythromycin
 - Omeprazole
 - Gastrografin



Enteral Nutrition

- “PRT on the effect of Cyclic vs Continuous Enteral Nutrition on postoperative Gastric Function after PPPD” - *van Berge Henegouwen Ann Surg 1997*
- 57pts rand - 24 hrs vs 18 hrs. No diff overall.
- Exclude tech prob - trend to less DGE with Cyclic

	Continuous Enteral Nutrition (n = 30)			Cyclic Enteral Nutrition (n = 27)			p
	Median	Mean	Range	Median	Mean	Range	
Nasogastric intubation (days)	5.5	9.1	1-65	4	6.7	1-25	0.82
Enteral nutrition (days)	9	10.3	1-28	8	9.3	0-27	0.60
First day of normal diet	11	15.7	5-68	9	12.2	5-38	0.04
Hospital stay (days)	17	21.4	9-73	14	17.5	10-46	0.04
Number of patients with DGE		7 (23%)			7 (26%)		0.82



Enteral Nutrition

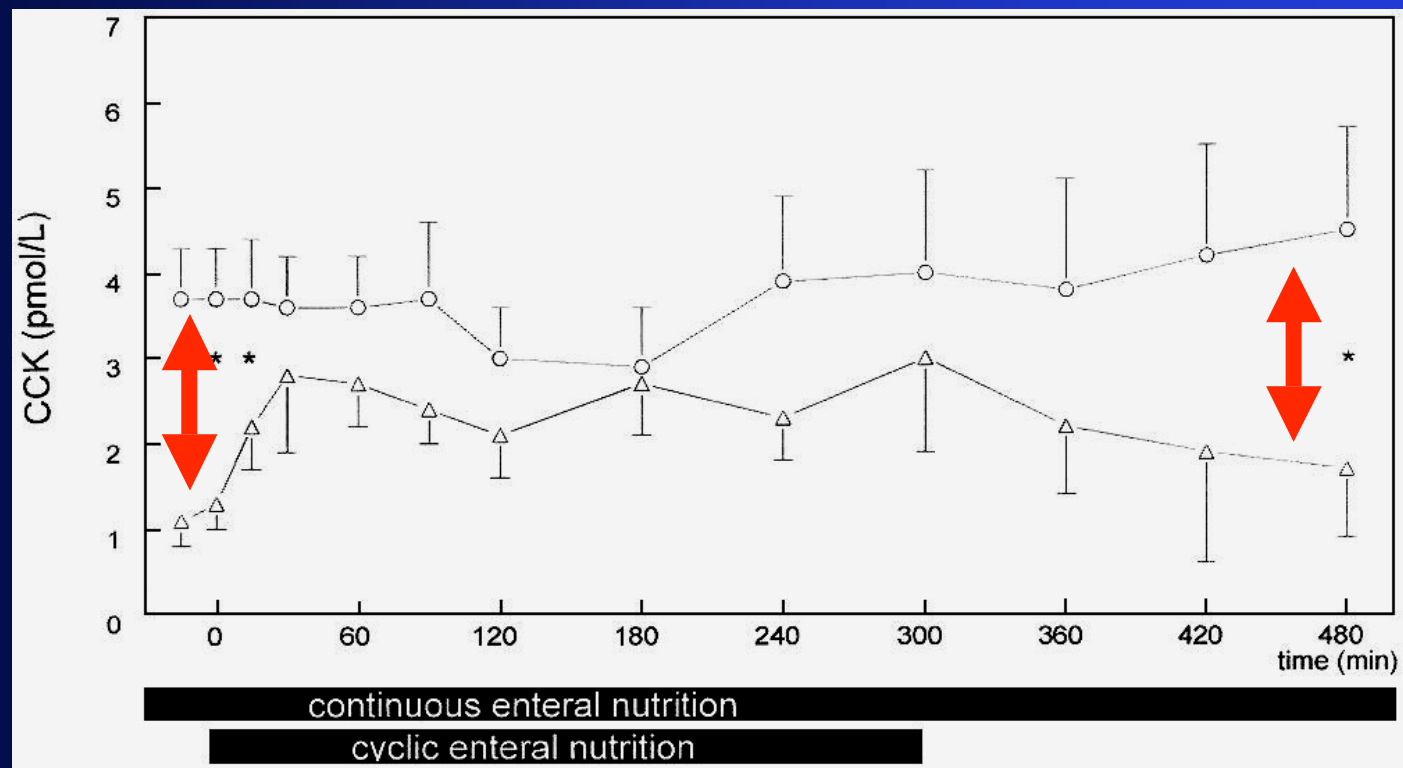
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Number of patients with DGE		7 (23%)			7 (26%)		0.82

	Continuous Enteral Nutrition (n = 19)			Cyclic Enteral Nutrition (n = 18)			p
	Median	Mean	Range	Median	Mean	Range	
Nasogastric intubation (days)	4	5.8	1-17	3	4.4	2-12	0.70
Enteral nutrition (days)	11	11.6	5-28	8	8.3	4-12	0.03
First day of normal diet	11	12.2	5-33	8	8.9	5-15	0.03
Hospital stay (days)	17	17.3	9-37	14	13.6	10-23	0.02
Number of patients with DGE		5 (26%)			3 (17%)		0.69

Enteral Nutrition

- Significantly lower CCK levels when feeds off





Enteral Nutrition

- If less is better, what about no enteral feeding??
- “Enteric Nutrition Prolongs DGE in Patients after Whipple Resection” -[Martignoni, Buchler et al. Am J Surg 2000](#)
 - 64 pts PPPD and Whipples
 - Jej feeds or not, selected by surgeons preference
 - DGE 57% vs 16% sig. No diff Whipples/PPPD
- Intestinal chyme→CCK→Inhibits gastric motility
- But isn't enteral feeding good....?



Enteral Nutrition

- Benefit not clear, complex area
- “A PRT of early Enteral Feeding After Resection of UGI Malignancy” - [Martin, Brennan et al. Ann Surg 1997](#)
 - 195 pts, jej feeds vs IV crystalloid
 - No diff major, minor or infective comp or LOS
 - No benefit in routine post op enteral feeding



Octreotide

- Inhibits secretion of motilin, secretin, CCK etc
- Decreases volume of pancreatic secretion
- **Connor et al. BJS 2005** Meta-analysis, ↓ comp
- **Van Berge Henegouwen et al. Gut 1997**
 - 8 healthy volunteers, 100mcg SC 8/24 vs placebo
 - Accelerated gastric emptying
 - Delayed small bowel transit
 - Does NOT contribute to DGE



Erythromycin

- Addresses reduction in circulating motilin levels
- Binds to motilin receptors → phase 3 activity
- Increases emptying rate
- Has been shown to be effective in ...
 - Diabetic gastroparesis and postvagotomy stasis
- Different effect at different doses
 - High dose 200-350mg, strong burst of antral contraction, not propagated to small bowel
 - Low dose 40mg, premature phase 3 which does migrate through small intestine sim to spont occurring one
- Also effective as suspension ie. jejunostomy use
 - Ehrenpreis et al. Aliment Pharmacol Ther 1998



Erythromycin - high dose

- Yeo et al. *Ann Surg* 1993
 - PRCT 118 pts, 200mg erythromycin 6/24 IV, D3-10
 - Broad def'n DGE, solid and liquid emptying study D10
 - Equal mix of total, classic and PPPD
 - Sig reduction in need for reinsertion of NG, 10% vs 25%
 - BUT not sig red in DGE 19% vs 30% (37% reduction)

Table 4. CLINICAL MEASURES OF DGE FOR ALL PATIENTS (n = 118)

	Erythromycin (n = 58)	Control (n = 60)	p Value
Postoperative nasogastric tube days	5.5 ± 0.2	6.2 ± 0.4	0.16
Postoperative day solid food begun	11.3 ± 0.8	12.8 ± 0.8	0.18
Emesis after nasogastric tube removed	11 (19%)	12 (20%)	1.00
Reinsertion of nasogastric tube	6 (10%)	15 (25%)	< 0.05
Nasogastric tube residual > 500 mL after reinsertion	5 (9%)	11 (18%)	0.18
Prokinetic agents started after postoperative day 10	11 (19%)	11 (18%)	1.00
Total parenteral nutrition begun postoperatively	9 (16%)	11 (18%)	0.81
DGE*	11 (19%)	18 (30%)	0.20
Total postoperative days	18.6 ± 1.4	17.7 ± 1.2	0.65

Defined as: (1) nasogastric tube in place ≥ 10 days plus one of following: (a) emesis after nasogastric tube removed; (b) use of prokinetic agents; (c) reinsertion of nasogastric tube; (d) failure to progress with diet; or (2) nasogastric tube in place < 10 days plus two of (a)–(d) above.



Erythromycin - low dose

- Ohwada et al. Ann of Surg 2001
 - PRCT, 31 pts, all PPPD, 1mg/kg 8/24, IV, D1-14
 - DGE def'n sim to Yeo. 14% vs 57% sig. (75% red'n)

Table 4. CLINICAL MEASURES OF DELAYED GASTRIC EMPTYING

	Erythromycin (n = 14)	Control (n = 14)	P Value
NG tube days (POD)	4.9 ± 0.5	12.4 ± 1.9	.001
NG removal within 3 PODs	7 (50.0%)	0	.008
NG left in place for 10 or more days	1 (7.1%)	8 (57.1%)	.002
Emesis after NG tube removal	1 (7.1%)	0	NS
Reinsertion of NG tube	1 (7.1%)	1 (7.1%)	NS
NG tube output >500 mL/day (days)	0.5 ± 0.2	7.5 ± 2.4	.002
NG tube output at POD1	1,011 ± 194	1,583 ± 266	.09
DGE	2 (14.3%)	8 (57.1%)	.04
Progress to diet (POD)	7.5 ± 0.8	14.7 ± 2.2	.003

NG, nasogastric; DGE, delayed gastric emptying; POD, postoperative day.



Omeprazole

- **Toyota et al. HepatoGastro 1998**
 - RCT, 42 pts, PPPD
 - 40mg omeprazole via jejunostomy vs nil
 - Significant decrease in gastric volume secretion
 - Significant decrease need for NG beyond 7 days



Gastrografin

- **Karavias et al. Int J Clin Pract 2002**
 - 5 pts, >2 wks DGE,
 - Failed metoclopramide and erythromycin
 - Empty stomach, Gastrografin 40mls, clamp NG, 2/24
 - All resolved within 36 hrs
 - ?decrease bowel wall oedema



Evidence

- Lack of good evidence in DGE
- No consensus on definition
- Many variations in procedure and post-op care
- Published data from very specialised centres
- Some post-op DGE (gastroparesis) may be normal



Reducing DGE

- No diff with PPPD
- Avoid intra-abdo complications (!!)
- Ante mesenteric, Ante colic, Bilroth II reconst'n
- Erythromycin - low dose
- Omeprazole and octreotide
- Avoid routine enteric feeding
- More study
 - Pyloromyotomy
 - Gastrografin



Therefore...

Delayed Gastric Emptying after PPPD.

Prevent it so you only rarely need to
fix it and then you can **forget it.**