

Evolution of Ligatures on Intestinal Loops with Biologic and Synthetic Threads

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Abstract

Objective: To investigate the causes of late failure of intestinal ligatures which may become permeable after a period of time.

Materials and Methods: Experimental research using cats. The animals were submitted to gastro-jejunal anastomosis associated ligatures of the pyloric and afferent jejunal loops, using different materials: group I - Cotton Cord (cordonnet), group II - Cotton Ribbon, group III - Synthetic (supramide) thread. The animals were observed from 15 to 82 days following surgery.

Results: The various ligature materials used for ligature tended to penetrate through the thickness of the intestinal wall though the visceral mucosa and to be later expelled into the lumen of the jejunum. Synthetic threads (supramide) provoked lesser tissue reaction than the biologic threads (cotton cord and ribbon).

Conclusion: External ligatures of intestinal loops tend to penetrate the various layers of the intestine and to be finally extruded to the interior of the gastrointestinal tract with recovery of the permeability of the previously ligated segments.

Keywords: Ligature Thread; Intestinal Loop Ligation; Sutures; Gastrointestinal Tract

Introduction

Reconstruction after total gastrectomy must build a food reservoir [1,2], maintain the route of ingested food through the duodenum and prevent intestinal secretion reflux to the esophagus, as recommended by prominent gastric surgeons like Roux, Henley, Tomoda -Rosanov, Steinberg and Orr.

The simple addition of an entero-enterostomy to the oesophago-jejunostomy or the more ornate pantaloon anastomosis may build a reservoir area [2,4-12]. The most important advantage of the Roux-en-Y technique is to function also as anti-reflux procedure [13-15].

Our aim herein is to investigate the causes of failure of the proximal intestinal segment bypass and occurrence of esophageal reflux of bile and pancreatic juice in various surgical techniques of reconstruction after total gastrectomy especially after thread ligature procedures.

Materials and Methods

Fifteen healthy adult cats of mixed sexes (male or females) weighting about 2000g were supplied by the central bioterium of the Faculty of Medicine, Ribeirão Preto - USP. The animals received oral prophylactic anti-parasites (metronidazole - 20 mg/kg/day) for 5 days, associated with mebendazole (20 mg/kg/day) for 3 days before surgery.

Latero-latero Gastro-jejunal and latero-latero jejuno-jejunal anastomosis were constructed. Ligatures of the pylorus and afferent jejunal loop just proximal to the gastro-jejunal anastomosis were added (Figure 1a), using different suture materials: Five animals compounded each group; I - Cotton cord (cordonnet) thread. II - Cotton Ribbon thread. III - Synthetic (supramide) thread. The animals were observed for signs of digestive problems, loss of appetite and regurgitation/vomit from 15 to 82 days following surgery (Table 1) and then submitted to a laparotomy.

Ligature Materials/Follow-Up Period In Days		Location of Ligature Thread in Loop Wall	
Before re-laparotomy			
		Juxta pyloric ligature	Jejunal afferent loop
			Ligature
Cotton Cord	15 days-permeable	Submucosa	Submucosa
Group-I	42 days-permeable	Submucosa	Submucosa
	45 days-permeable	Submucosa	Submucosa
	63 days-permeable	Submucosa	Eliminated
	67 days-permeable	Submucosa	Submucosa
Cotton Ribbon	63 days-permeable	Submucosa	Submucosa
	61 days-permeable	Mucosa	Mucosa
	63 days-permeable	Submucosa	Submucosa
	67 days-permeable	Submucosa	Submucosa
Supramide	62 days-permeable	Submucosa	Submucosa
	27 days-impermeable	Serosa-intact	Serosa-intact
	49 days-permeable	Mucosa	Mucosa
	62 days-permeable	Submucosa	Submucosa
Group-III	63 days-impermeable	Serosa-intact	Serosa-intact
	64 days-permeable	Submucosa	Submucosa
	Mean post operatory		
	Follow-Up = 53.7 days		

Table 1: Evolution of ligatures according to the Loop location, type of surgical material used (COTTON CORD-CORDONNET-group I, COTTON RIBBON- group II and SUPRAMIDE-group III).

Results

All animals were subjected to macroscopic and histologic analysis after resection of specimen and location of ligature loops by laparotomy under anesthesia and before euthanasia. The various kinds of materials (cotton and synthetic threads) used for ligature tended to penetrate through the thickness of the serosa of the intestinal wall through the visceral mucosa and to be expelled into the lumen of the jejunum (Figures 1b, 1c, 1d and figure 2). Various grades of microscopic alterations signaling an inflammatory process were confirmed after ligature, mainly related to cotton materials, with similar signs on different layers of the loops. Lesser tissue reaction was observed with synthetic thread, which was limited to the mucosa, showing normal epithelium and inflammatory infiltration of the lamina propria. For biological materials (cotton cord and ribbon) an intense allergic reaction was accompanied by giant cells *granulomae* on the submucosa, containing cotton threads, with intensive fibrosis on the muscular layer (white region). The serosa layer showed severe chronic inflammatory reaction and chronic peritonitis (Figures 2a-2d). Two ligated loops persisted impermeable in group-I at 27th days and 63rd days follow-up.

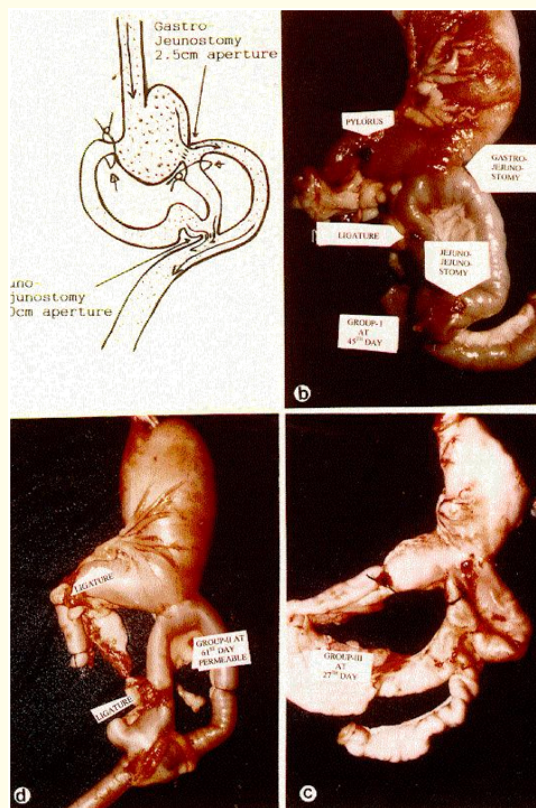


Figure 1: (a) Diagrammatic representation of the procedure of side-to-side gastro-jejunostomy and jejuno-jejunostomy, small arrows to the ligature points. (b) Group I - a macroscopic illustration of ligature points showing absence of threads at 45th post operation day. (c) Group III - a macroscopic illustration of ligature threads (synthetic) still intact on the serosa of juxto-pyloric and jejunal afferent loops at 27th post operation day. (d) Group II- illustrating repermeability after tying both ends of loops and water injected through the stomach proving absence of ligature threads at 61st post operation day.

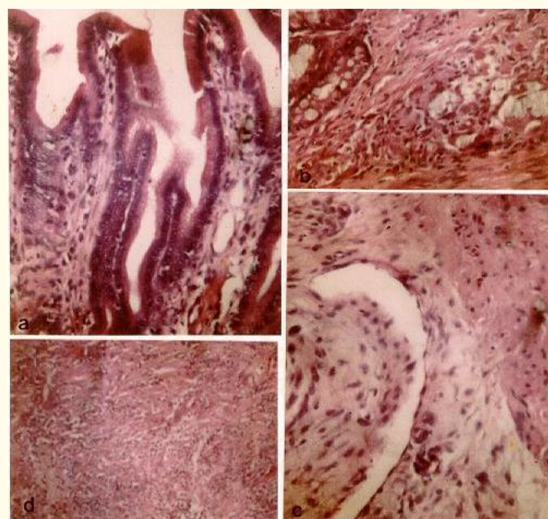


Figure 2: Various grades of microscopic alterations of inflammatory process after ligation, principally by cotton threads (group I and II) with similar signs on different layers of the loops. (a) Mucosa showing an integral epithelium and inflammatory infiltration on the lamina propria (HE 400 x). (b) Granuloma on the submucosa with giant cells and various cotton threads within (HE 160 x). (c) Granulation with intensive fibrosis (white region) on the muscular layer (HE 400 x). (d) Showing serosa layer with intensive chronic inflammatory reaction and chronic peritonitis (HE original magnification 160 x).

Discussion

Our results helped us to elucidate the reasons for failure after ligatures in the gastrointestinal tract. Those results may also apply to Cardio-vascular surgery and urologic surgery, although not tested herein. In Gynecology and Obstetrics, for example, unwanted pregnancy may be due to Fallopian tube re-permeation. Considering our findings, maybe simple ligature should be substituted for section of the tubes. Also, in Urology, ligature techniques for vasectomy have been abandoned for section of the vas deferens, in order to secure anti-conception.

Conclusion

In conclusion, the three different materials used for ligatures in this research tended to cause biological reactions in the gastrointestinal tissues and tended to slowly penetrate the various layers of the intestine, to be finally extruded to the interior of the gastrointestinal tract, with recovery of the permeability of the previously ligated segments.

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