EVALUATION OF MAGNETIC ANASTOMOSIS DEVICE FOR GASTROJEJUNOSTOMY IN A SWINE MODEL OVER 6 WEEKS

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Background

Conventional gastrointestinal anastomoses have been made with sutures and/or staples yet have resulted in significant leak and bleeding rates. The study objective was to evaluate a new design of linear magnetic compression anastomosis (MCA) device for gastrojejunostomy (GJ) and to determine its safety and efficacy in a swine model at 6-week follow-up.

Methods

Eight female domestic farm pigs, aged 3-6 months, weighing 55.5-79.2 kg, underwent GJ. A proximal magnet was inserted into the stomach using a gastroscope and a delivery catheter. The target gastric anastomosis site was marked with a suture. The distance from the site to the ligament of Treitz was measured using pre-measured umbilical tapes and a small enterotomy was made laparoscopically through which a distal magnet was positioned at the identified jejunal site; the enterotomy was closed with a suture. The jejunal magnet was brought into alignment with the gastric magnet [**Fig.1**] to gradually form an anastomosis, detach as a fused pair, and be expelled naturally [**Fig.2**].

After the procedure, the animals were observed for approx. 6 weeks (41-46 days). Beginning 7 days post MCA device insertion, follow-up radiographs were performed 3 times per week to track the eventual movement of the fused magnets through the intestines. At the scheduled time of sacrifice, the animals were euthanized, and a limited necropsy was performed in which the anastomosis and enterotomy sites were harvested for histological evaluation.

Fig. 1. Magnetic gastrojejunostomy by pairing of two linear compression magnets



Results

The fused magnets dislodged from the GJ between 10–26 days and were expelled between 16–31 days. In all animals, MCA was successfully achieved as verified at final gastroscopy and necropsy at 6 weeks.

On histological examination at study end, the magnets appeared to have induced patent GJ anastomoses with minimal inflammation [**Fig.3**]. There was mild fibrotic disruption of the muscularis and loss of intestinal smooth muscle at the site; however, all animals had a patent anastomotic lumen. This contrasted with suture implantation at the enterotomy sites, which contained a greater degree of injury, inflammatory response, and disruption of mucosal and serosal integrity.

Fig. 2. After gradual gastrojejunostomy anastomosis formation, the fused magnet pair detaches and is expelled naturally

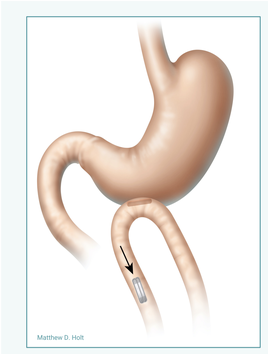
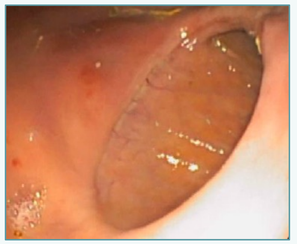


Fig. 3. Endoscopic view of patent magnetic gastrojejunal compression anastomosis (6 wks)



Conclusions

In summary, in a large animal model, the use of a linear magnetic compression anastomosis device to induce a GJ was associated with a good healing response characterized by low levels of inflammation and no, or minimal, tissue disruption at 6 weeks postoperatively compared to enterotomy site suture closures, which were associated with greater inflammation and tissue damage. In addition, the novel MCA device successfully induced patent anastomoses and was well tolerated with no abnormal clinical signs related to its use. These findings suggest that this MCA device may be suitable for use in clinical gastrointestinal procedures.