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Influence of Different Magnetic Forces on the Effect of Colonic Anastomosis in Rats

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Introduction

Magnetic compression anastomosis, which is a new type of anastomosis, has been extensively studied in digestive tract anastomosis in animals and humans. Previous studies have focused on the feasibility and safety of different magnetic designs for gastrointestinal anastomosis. Moreover, some scholars have proposed the hypothesis that magnetic force may affect the anastomosis effect.

In this study, two groups of magnets matched for shape and size but with different magnetic forces were used in colonic side-to-side anastomosis experiments.

Material and methods

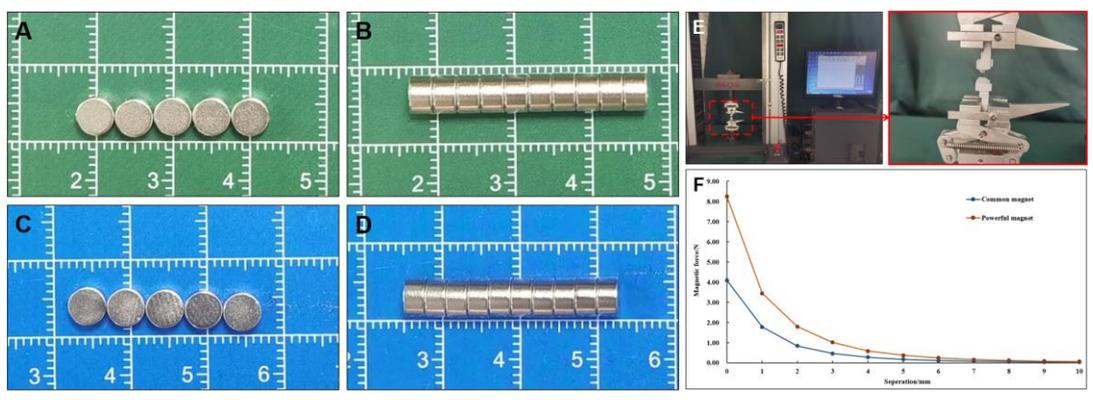

Fig. 1 Magnets and magnetic force test.
A. Front view of the powerful magnet.
B. Side view of the powerful magnet.
C. Front view of the common magnet.
D. Side view of the common magnet.
E. Magnetic force test procedure.
F. Magnetic force curve of the magnet.

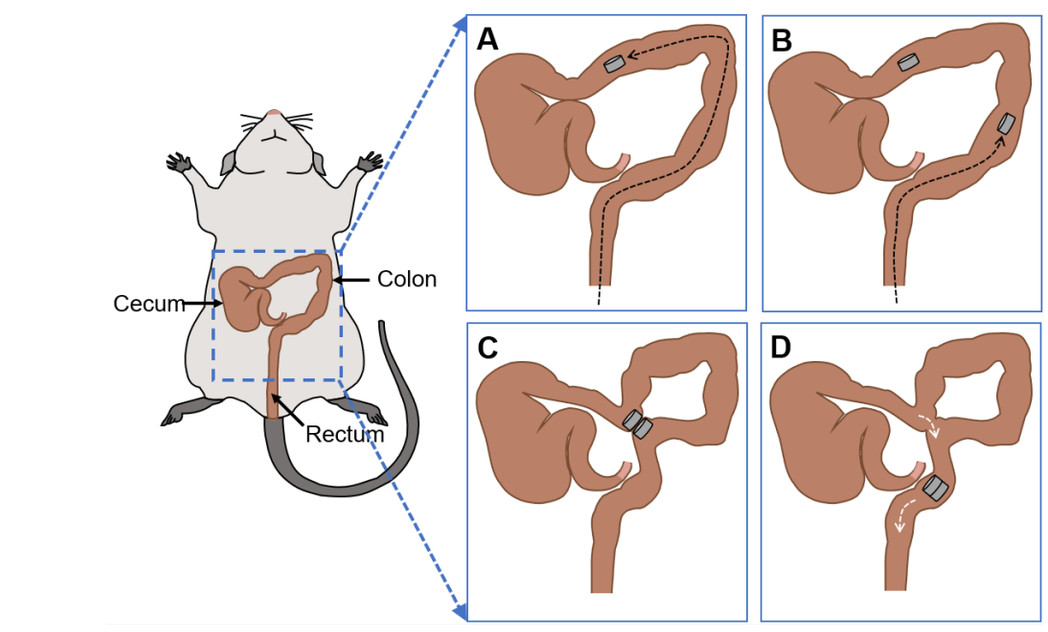

Fig. 2 Schematic presentation of the surgical procedure.
A. A magnet is inserted through the anus into the proximal portion of the colon.
B. Another magnet is inserted through the anus to the distal end of the colon.
C. The two magnets in the colon are attracted.
D. The magnets enter the rectum after a side-to-side colonic anastomosis is established.

Results

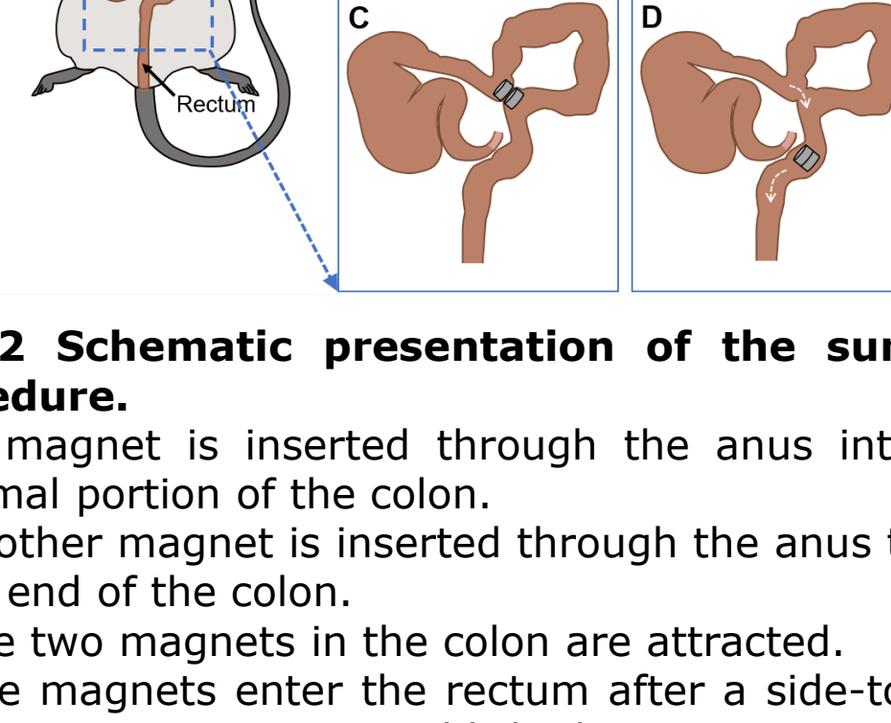

Fig. 3 Surgical procedure.

A. A powerful magnet is placed in the proximal colon.
B. A powerful magnet is placed in the distal end of the colon.
C. The two powerful magnets are attracted.
D. A common magnet in the proximal colon area.
E. A common magnet in the distal end of the colon.
F. The two common magnets are attracted.

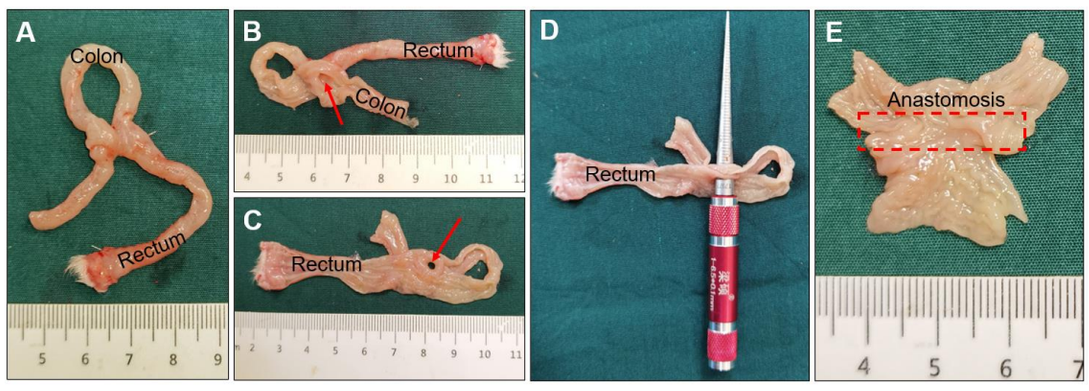

Fig. 4 Anastomotic gross specimen of the powerful magnet group.
A. Gross specimen of colon anastomosis.
B-C. The anastomosis observed after a longitudinal dissection of the colon.
D. Measurement of the anastomotic diameter.
E. Colonic anastomosis observed on the mucosal surface.

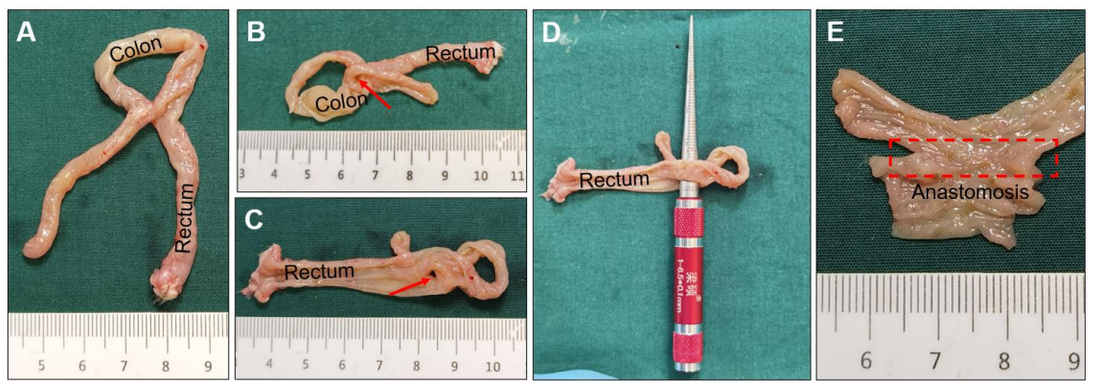

Fig. 5 Anastomotic gross specimen of the common magnet group.
A. Gross specimen of colon anastomosis.
B-C. The anastomosis observed after a longitudinal dissection of the colon.
D. Measurement of the anastomotic diameter.
E. Colonic anastomosis observed on the mucosal surface.

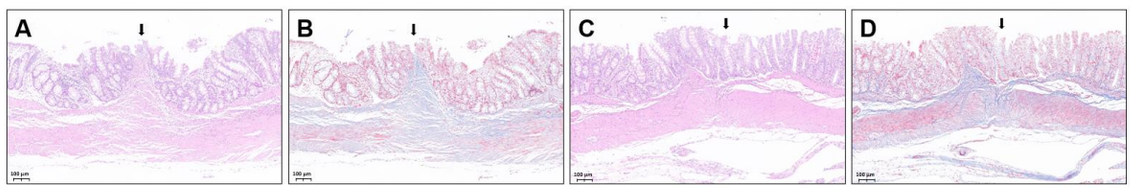

Fig. 6 Histological images of the colonic anastomosis.
A. Hematoxylin and eosin staining of the colonic anastomosis in the powerful magnet group.
B. Masson's staining of the colonic anastomosis in the powerful magnet group.
C. Hematoxylin and eosin staining of the colonic anastomosis in the common magnet group.
D. Masson's staining of the colonic anastomosis in the common magnet group.

Conclusion

The present results establish that a magnetic force of >4 N had no significant impact on the effect of colonic side-to-side anastomosis in rats. This observation suggests that the minimum magnetic force, rather than the maximum force, required to achieve the anastomosis warrants our attention in the MCA of the digestive tract.

Based on these results, a preliminary hypothesis regarding MCA was proposed, referred to as the "Yan-Zhang's Magnetic Force Sea-Level Theory": In gastrointestinal magnetic compression anastomosis, as it is constrained by anatomical and functional, the God limits of magnetic force cannot be reached, yet the lower limits determine whether the result is submerged in icy seawater or basking in the warm sunshine.