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# Endoscopic transmural route for dissection of gastric submucosal tumors with extraluminal growth: experience in two cases

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## MESSAGES

The spectrum of endoscopic resection methods, including full thickness techniques, has enabled removal of most smaller gastric submucosal tumours (SMTs). We developed an extended transmural endoscopic dissection technique for lesions with predominately extraluminal growth arising from the muscularis propria. It consists of transmural intraperitoneal access with the endoscope besides the lesion followed by subserosal dissection from the outside. The technique was successful in two patients with smaller (2–3 cm) gastric stromal tumours; lesions were resected completely and short-term follow-up was normal. Further studies are warranted to confirm the safety and feasibility of this this new approach.

## IN MORE DETAIL

With the popularisation of endoscopy and the development of endoscopic ultrasonography (EUS), the detection rate of gastrointestinal (GI) SMT has increased significantly.[1] Complete surgical resection is still recognised as the primary and the most important way to treat gastric SMT and to get clear pathological diagnosis.[2] Minimally invasive endoscopic therapy received increasing recognition due to its advantages of less invasiveness, fewer complications, quicker recovery and lower costs compared with open surgery or laparoscopic surgery. Gastric SMTs derived from mucosal and submucosal layers could be resected by endoscopic mucosal resection and endoscopic submucosal dissection, while those originated from deep layers of the gastric wall can be resected using endoscopic full-thickness resection (EFTR), which intentionally perforates the gastric wall to achieve complete resection.[3] With an increasing emphasis on protecting the intact of mucosa, endoscopic mucosa-sparing lateral dissection was developed to reduce the postoperative complications.[4] Inspired by the submucosal tunnelling endoscopic resection (STER)[5] technique, in which maintenance of mucosal integrity and the longitudinal submucosal tunnel lead to rapid healing and decreased risk of pleural infection, STER for extraluminal tumours was reported for resection of SMTs with a predominant extraluminal growth pattern or extra-GI tumours.[6] However, for most SMTs with a predominately extraluminal growth pattern, the lesions are usually in a tangent position during endoscopic dissection in all the above techniques. The endoscopic view from gastric lumen is inherent poor for the reason that only very small part of the tumour can be seen from inside. In addition, the highly movable tumour with limited endoscopic exposure increases the difficulty in the en bloc resection as well as safe haemostasis. To overcome these disadvantages, we try to develop an extended transmural endoscopic dissection technique, for the removal of gastric SMTs with a predominately extraluminal growth pattern. This novel technique not only retains mucosal integrity, but also provides better working space as well as exposure and stabilisation of the lesion.

## PATIENT HISTORY

The first case (case 1) was a 77-year-old man admitted for a gastric 'SMT' found on a routine check-up at a local hospital by regular oesophagogastroduodenoscopy (OGD) examination for 1 month. His medical history was unremarkable. Contrast-enhanced CT of the abdomen showed a mass located on the gastric wall with predominantly extraluminal growth. No metastasis to the lymph nodes or other organs was seen on the CT scan. EUS revealed it to be well demarcated, approximately 2.2×1.8 cm in diameter, and originated from the deep muscularis propria. OGD exploration at our hospital showed a smooth-elevated bulging lesion in greater curvature of the gastric body. After a full discussion, the extended transmural endoscopic dissection technique was attempted.

The second case (case 2) was a 37-year-old man admitted for a 'SMT' in the anterior of the greater curvature of the gastric body found on a routine OGD check-up for 1 week at our hospital. His medical history was also unremarkable. Contrast-enhanced CT of the abdomen showed a 2.5-cm mass with only limited tissue connected to the gastric wall. The extended transmural endoscopic dissection technique was also attempted.

## DESCRIPTION OF TECHNOLOGY

The patients are under general anaesthesia with endotracheal intubation. Prophylactic intravenous antibiotics are introduced 30 min before the procedure. $CO_2$ is used routinely during the operating procedure, and a 20-gauge needle is inserted into the right lower quadrant to relieve the intraoperative pneumoperitoneum when necessary. The specific steps of our technique are as follows (figure 1).

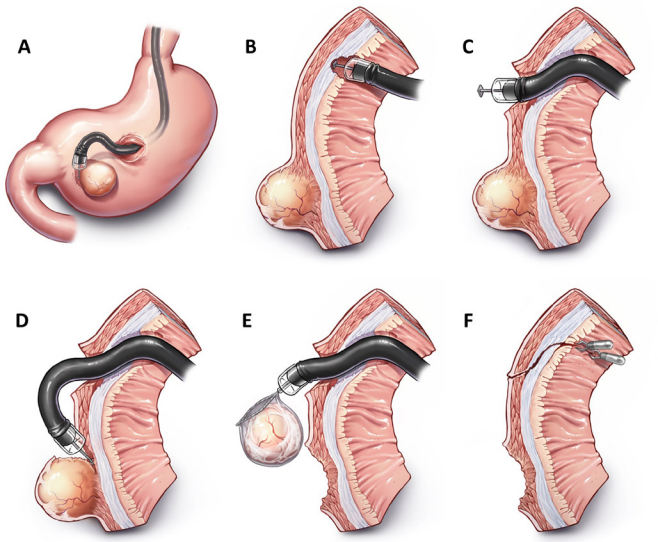


**Figure 1** Endoscopic intraperitoneal subserosal dissection (EISD) illustrations. (A) EISD. (B) Mucosal incision. (C) Submucosal tunnelling. (D) Intraperitoneal subserosal dissection. (E) Lesion removal. (F) Mucosal closure.

Step 1. Mucosal incision: a 1.5-cm gastric mucosal incision is created about 4-cm proximal to the lesion after submucosal injection of diluted indigo carmine.

Step 2. Submucosal tunnelling: a short submucosal tunnel is created between the submucosa and muscularis propria, and the gastric muscularis propria is then intentionally perforated about 3 cm away from the lesion. The 3-cm distance provides critical working space and better visualisation of the lesion.

Step 3. Intraperitoneal subserosal dissection: after locating the lesion on the serosa of the gastric wall from the abdominal cavity, the tumour is carefully dissected from the serosa and the underlying muscularis propria without interruption of the tumour capsule. Subserosal injection is performed when necessary to create working space or to identify the layers. Caution should be taken to avoid the damage of the integrity of the mucosa during the dissection.

Step 4. Lesion removal: when the lesion is full resected, it is extracted from the abdominal cavity to gastric cavity and out of the patient by using a snare.

Step 5. Mucosal closure: after careful haemostasis, the tunnel entrance is closed with endoclips.

## VIDEO DESCRIPTION

The online supplemental video 1 showed the removal of a 2.2-cm SMT in greater curvature of the gastric body originated from the deep muscularis propria with predominantly extraluminal growth (figure 2). The mucosal incision was made on the posterior of the greater curvature. The operating time was 70 min.

The online supplemental video 2 showed the resection of a 2.5-cm SMT in the anterior of the greater curvature of the gastric body (figure 3). The mucosal incision was made on the anterior of the gastric body. The total operating time was 65 min.

## POSTOPERATIVE COURSE

A gastric tube was placed for depression as well as active monitoring of bleeding. Postoperative antibiotics and proton pump inhibitors were routinely administered. For case 1, the gastric tube was removed on postoperative day (POD) 1, and

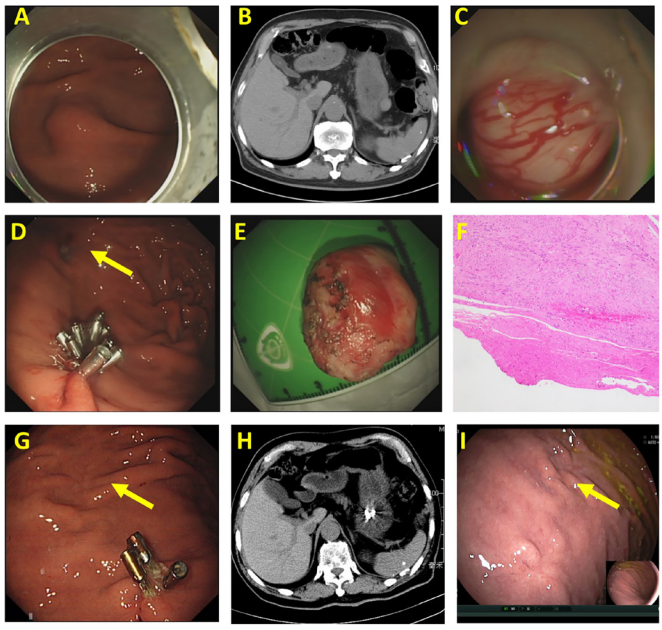


**Figure 2** Case 1. A 2.2-cm gastric submucosal tumour resected by endoscopic intraperitoneal subserosal dissection (EISD). (A) Endoscopic view. (B) Preoperative CT. (C) Intraperitoneal endoscopic view. (D) Intact mucosa after EISD. (E) Resected tumour. (F) Pathology. (G) Endoscopy after 3 months. (H) CT after 3 months. (I) Endoscopy after 6 months. Yellow arrows show tumour site.

the patient was discharged on POD 2. Pathological evaluation revealed a 2.0×1.7×1.5-cm mass, with a GI stromal tumour, abundant spindle cell type, characterised with mild atypia and rare mitotic phase. R0 resection was achieved with complete capsule. The maximum diameter of the tumour was 1.7 mm under microscope. Immunohistochemistry results showed

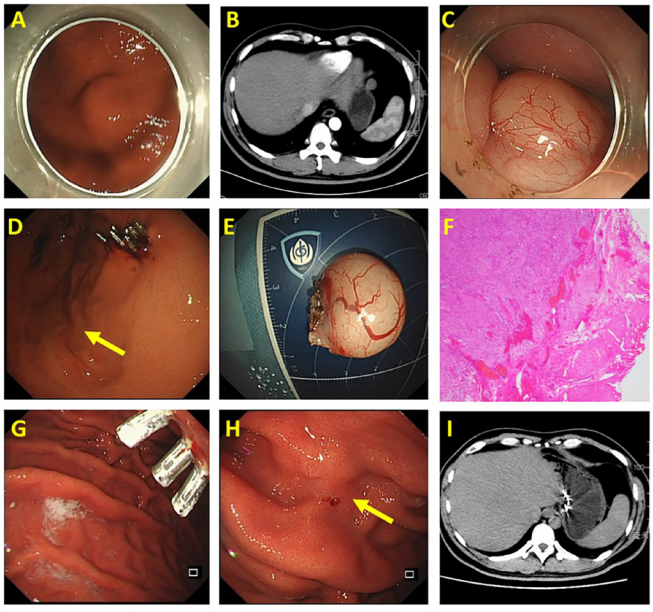


**Figure 3** Case 2. A 2.5-cm gastric submucosal tumour resected by endoscopic intraperitoneal subserosal dissection (EISD). (A) Endoscopic view. (B) Preoperative CT. (C) Intraperitoneal endoscopic view. (D) Intact mucosa after EISD. (E) Resected tumour. (F) Pathology. (G,H) Endoscopy after 2 months. (I) CT after 2 months. Yellow arrows show tumour site.

CD34(+), CD117(weak+), DOG-1(+), DES(−), SOX10(−), SDHA(+) and Ki67(1%+). Special staining was done: reticulated fibre staining (−). The pathologic diagnosis met the cell-rich GI stromal tumour (WHO, 5th edition of Digestive System Tumours, prognostic group, group 1). The OGD and CT follow-up 3 months later showed several clips remaining and OGD follow-up 6 months later showed complete healing. For case 2, the gastric tube was removed on POD 1, and patient was discharged on POD 3. On pathological evaluation, the specimen was a 2.0×1.8×1.5-cm mass with complete capsule (R0 resection). Microscopic examination showed an abundant spindle cell type GI stromal tumour with mild atypia, and mitosis was about 10 per 50 HPF. Immunohistochemistry results showed CD34(+), CD117(+), DOG-1(+), DES(−), SMA(−), S100(−), Ki67(5%+), SDHA(+) and SHDB(+). The pathologic diagnosis was a cell-rich borderline/low-grade malignant GI stromal tumour (WHO, 5th edition of Digestive System Tumours, prognostic group, group 5). After careful discussion with the patient and multidisciplinary team, regular follow-up was recommended. Follow-up CT and OGD after 2 months showed satisfactory healing with no residual tumour.

## COMMENTS

This extended transmural endoscopic dissection technique, we named it endoscopic intraperitoneal subserosal dissection (EISD), is a novel technique based on natural orifice translumenal endoscopic surgery (NOTES), STER and EFTR, for the removal of gastric SMTs with a predominately extraluminal growth pattern. As a new form of NOTES, it has clear advantages of less invasiveness, fewer complications, quicker recovery and lower costs over surgical approaches. Without skin incisions, EISD also offers the potential for performance of true scarless and painless resection of gastric SMTs.

The advantages over conventional endoscopic resection techniques are also appealing. First, the maintaining of mucosa intact at the lesion site and the short tunnel at the mucosal incision site could reduce infection and other complications due to perforation resulting from full-thickness resection. Second, the tunnel makes closure of the wound much easier than the otherwise unsmooth full-thickness defect created by EFTR. More importantly, the distance between the perforation and the lesion enables the operator to have a direct and full exposure of the lesion from the abdominal cavity instead of the tangent view from the gastric cavity, which provides the critical view of safety both for dissection and haemostasis. In addition, for most SMTs with a predominately extraluminal growth pattern, only a small portion of tissue connected to the deep layer of muscularis propria and the serosa. In traditional EFTR or STER, the highly movable tumours challenge the angle of the scope and increases the risk of tumour residual and capsule damage; while on the contrary, dissection from the serosal side in the abdominal cavity helps to stabilise the lesion.

With these advantages in mind, the potential risks should also be considered such as severe bleeding or violation of vital intraabdominal structures. Therefore, the procedure should only be performed on selected patients without severe adhesion, by experienced hands with surgeons standby.

To ensure the safety and efficacy of this procedure, the following steps should be taken. First, preoperative preparation should never be overemphasised. CT and EUS should be performed to confirm the location of the lesion and its relationship with important intraabdominal structures. Second, $CO_2$ should be routinely used to decrease the risk of gas-related adverse events. In the design phase of the EISD procedure, one important hint is to choose an appropriate site for tunnel entrance and full-thickness perforation to keep the freedom of the scope for subsequent exposure and dissection. In our experience, a proximal (oral site) incision is easier to deal with than a distal one (anal site). During the procedure, dissection should be carefully performed close to the tumour capsule to avoid the damage to the integrity of the mucosa as well as to surrounding structures. Last but not least, postoperative monitoring is equally important to find potential sign of adverse events.

In conclusion, EISD is a feasible and safe attempt for the removal of gastric SMTs with a predominately extraluminal growth pattern, and large-scale prospective studies are needed to evaluate its safety and efficacy.

**Contributors** Planning and conducting the study: JH and PZ. Collecting data: XL. Clinical review and discussion: XL, TC, JC, PG, QL, WC and YZ. Drafting manuscript: XL and JH. Final approval of manuscript: all authors.

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