

Endoscopy for Surgeons

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What is Endoscopy?

Endoscopy means “looking inside”, and in medical science, it refers to looking inside the body using an endoscope for medical reasons. The endoscope is an instrument used to examine the interior of a hollow organ or cavity of the body, by directly inserting it. The endoscopy is used in almost all specialties of medical science, like Surgery, Gynaecology, ENT and Orthopaedics. Table 1 shows the various endoscopic procedures.

Besides these there are a few other special endoscopic procedures in different specialties with a therapeutic and surgical aspect. Table 2 lists the special endoscopic procedures:

Surgeon and the Gastroenterologist

The gastrointestinal tract, more than any other organ system has particularly benefited from the technological advancements and technique refinements of endoscopy. Endoscopy has largely been practiced by the gastroenterologist worldwide, since it established its role and remarkable accessibility in diagnosing diseases with precision.

In view of general surgery, flexible endoscopy is increasingly becoming important in practicing the commonly performed surgical procedures. As many as fifty percent of practicing surgeons depend on colonoscopy

Table 1

S No	System	Part Examined	Endoscopic Procedure
1	Gastrointestinal Tract	Pharynx	Pharyngoscopy
		Esophagus + Stomach + Duodenum	Esophagoduodenoscopy
		Small Intestine	Enteroscopy
		Colon	Colonoscopy
		Sigmoid Colon + Rectum	Sigmoidoscopy
		Rectum	Rectoscopy
		Rectum + Anus	Proctoscopy
		Anus	Anoscopy
2	Respiratory Tract	Bile Duct	Cholangioscopy
		Nose	Rhinology
		Larynx	Laryngoscopy
		Trachea + Bronchi	Bronchoscopy
3	Urinary Tract	Urinary Bladder	Cystoscopy
		Kidney	Nephroscopy
		Ureter	Ureteroscopy
4	Female Reproductive System	Cervix	Colposcopy
		Uterus	Hysteroscopy
		Fallopian Tubes	Falloscopy

Table 2

S No	Indication	Part Examined	Special Endoscopic Procedure
1	Closed Body Cavity Through Small Incision	Abdominal Or Pelvic Cavity	Laparoscopy
		Interior Of A Joint	Arthroscopy
		Organs Of The Chest	Thoracoscopy And Mediastinoscopy
		Epidural Space	Epiduroscopy
		Hand Surgery	Endoscopic Carpel Tunnel Release
2	During Pregnancy	The Amnion	Amnioscopy
		Fetus	Fetoscopy
		Embryo	Embryoscopy

and upper gastrointestinal endoscopy for substantial proportion of their practice.

In the present era, there is an enthusiasm towards combining the talents and experience of surgeons and gastrointestinal endoscopists for moving towards development of procedures for scarless surgeries. The diagnostic potentials of endoscopy had long been established, and that paved way for many endoscopic therapeutic procedures which changed the management and outcome of many disease processes. To mention a few, the role of therapeutic endoscopy in variceal bleeding and cholangitis made a mark by reducing the high mortality in these situations. Innovations continued and that has led to the possibilities of performing various surgeries through natural orifices without making incisions over the abdominal wall. This has renewed the interest of surgeons to learn endoscopy in order to move ahead with the growing minimally invasive surgery.

Advances in endoscopic surgeries

Therapeutic endoscopy has a role to play in various benign and malignant conditions of the gastrointestinal tract. Table 3 & 4 show the endoscopic procedures used in various situations.

The therapeutic endoscopic procedures mentioned in Table 3 & 4 are performed by endoscopists, who are either medical gastroenterologists or surgeons. The surgeons perspective to therapeutic endoscopy is the development of innovative procedures like NOTES. In an attempt to minimize surgical

Table 3: Therapeutic Endoscopy In Benign Gastrointestinal Conditions

S. No	Part Of Git	Benign Condition	Endoscopic Procedure
1.	Esophagus	Esophageal Varices	Endoscopic Sclerotherapy, Endoscopic Banding, Glue
		Achalasia Cardia	Endoscopic Dilatation, Endoscopic Myotomy, Sclerodestruction, Botulinum Toxin Injection
2.	Stomach And Duodenum	Bleeding Ulcer	Injection Sclerotherapy, Heater And Laser Probes, Endoclips
		Gastric Varices	Glue
3.	Hepatobiliary	Polyps	Snare Polypectomy
		Cbd And Pancreatic Duct Stricture / Trauma	Dilatation And Stenting
4.	Large Bowel	Cbd And Pancreatic Duct Stone	Endoscopic Sphincterotomy, Calculi Removal Via Dormia Or Balloon
		Polyps	Polypectomy

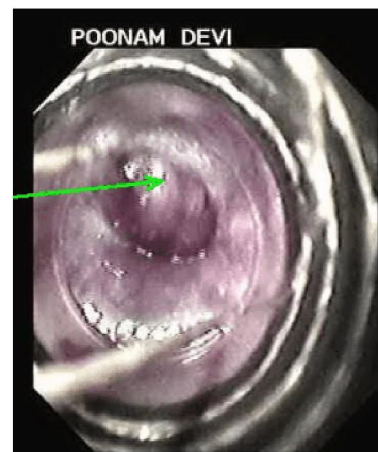
Fig 1: Endoscopic Banding For Esophageal Varices**Fig 2: Snare Polypectomy Of Colonic Polyp**

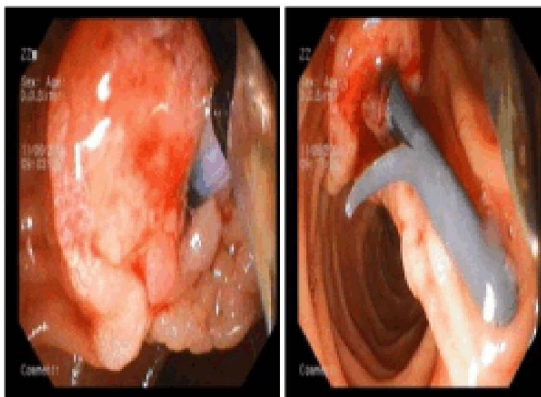
Table 4: Therapeutic Endoscopy In Malignant Gastrointestinal Conditions

S. No	Part OfGIT	Therapeutic Endoscopic Procedure
1.	Esophageal Cancer	- Ablative therapy - Photodynamic therapy (PDT), Argon Plasma Coagulation (APC), Multipolar Electrocoagulation - Endoscopic Mucosal Resection (EMR) and Endoscopic Submucosal Dissection (ESD) - Esophageal stenting
2.	Gastroduodenal Cancer	- EMR and ESD - PDT, APC - Stenting
3.	Pancreatic-Biliary Malignancy	- Biliary stenting - metal and plastic - Pancreatic stenting - PDT
4.	Colorectal Malignancy	- Colonoscopic polypectomy - EMR and ESD - Colonic decompression tubes, SEMS (self expanding metal stents), Laser therapy, APC

trauma and make scarless surgeries possible, the endoscopic principles and laparoscopic techniques were combined to result in NOTES.

In the present scenario, the various procedures developed in surgical endoscopy are:

- I. NOTES (Natural Orifice Transluminal Endoscopic Surgery)
- II. Procedures for obesity
 1. Stomaphy X
 2. ROSE (Restorative Obesity Surgery, Endoluminal)
 3. Endobarrier
 4. TOGA (Trans-oral gastroplasty)
 5. POSE (Primary Obesity Surgery endoluminal)

Fig 3: Ercp Plastic Stenting In A Case Of Periampullary Carcinoma

III. LESS (Laparo-endoscopic Single site Surgery)

I. NOTES (Natural Orifice Transluminal Endoscopic Surgery)

NOTES is considered by some to be the next revolution in surgery. It is an exciting concept, and the foundation is to access the peritoneal and other body cavities through the wall of the alimentary tract, via natural orifices, with the goal of performing procedures within the peritoneal and other cavities, without the need to make incisions in the abdominal wall. This novel technique is still in clinical trial phase, and is gradually proving its safety with the newly designed instruments and devices, specific to its needs. NOTES has been successfully used for cholecystectomy and appendectomy. Its potentials have also been seen in pancreatic diseases, like for cyst drainage, necrosectomy and distal pancreatectomy. Also the technical feasibility has been seen for gastro-intestinal anastomoses like gastrojejunostomy, enetero-enteral anastomosis and ileocolonic anastomoses using hybrid NOTES technique. Usefulness of NOTES has also been proved in urological procedures like prostatectomy.

NOTES can be used via the transgastric, transvaginal, transcolonic and transvesical routes. Further advancements are aimed at using the pouch of Douglas in these procedures, to further enhance the safety of these techniques.

The various issues that need to be addressed before NOTES is ready for widespread clinical use are prevention of infection, instrument development and the ability to recognize and treat intraperitoneal complications, such as hemorrhage and other physiologic adverse events. Also is needed a prospective multicentric clinical trial comparing NOTES to standard laparoscopy to finally lead to this paradigm shift in surgery.

II. Endoscopic Procedures for Obesity

The weight loss surgery has traditionally been considered the treatment of last resort

for severe obesity. But with the newer endoscopic surgical methods like NOTES, more people are opting for surgeries at a much earlier stage. There are FDA approved endoscopic procedures like Stomaphy X and ROSE for gastric bypass revision, already in use. There are other promising primary endoscopic procedures for obesity under clinical trials – Endobarrier, TOGA and POSE.

As many as 15 to 20% of people who have gastric bypass surgery for obesity, start regaining weight within three to five years. This occurs because the newly created stomach pouch and stoma (connection between the stomach and intestine) can gradually stretch as the body adapts to changes. As the stoma gets larger, the stomach empties faster and people don't feel full as they once did, and eat more, finally regain weight. In order to re-shrink the stomach, two endoscopic methods have been approved by FDA – Stomaphy X and ROSE.

1. *Stomaphy x*

The stomaphy X device is an endoluminal fastener and delivery system that consists of an ergonomic, flexible fastener delivery device and sterile polypropylene fastener implants. It is used transorally for non-invasive tissue approximation and full thickness placcation in GI tract. It is used by Bariatric surgeons to further reduce the volume of the small stomach pouch created by primary Bariatric procedures like Roux-en-Y or Gastric bypass procedures.

Stomaphy X may benefit in revisional surgeries for bariatric procedures like Gastric bypass, duodenal switch or sleeve gastrectomy and is also useful in stomach fistula or leak and in severe dumping syndrome.

2. *ROSE (Restorative Obesity Surgery, Endolumenal)*

The ROSE procedure uses an operating system similar to an endoscope with four channels through which specialized instruments are introduced into the stomach, and the stoma created by the previous bariatric

surgery is sewed up. Sutures are placed with tissue anchors to create multiple folds around the stoma to reduce its diameter, and then placed in the stomach pouch to reduce its capacity. The final result is slower emptying of stomach, giving feeling of fullness, leading to weight loss.

The other upcoming primary endoscopic procedures for obesity are discussed here.

3. *Endobarrier*

GI Dynamics has come out with a device called Endobarrier, which is essentially a gastro-intestinal impermeable liner, that lines the first two feet of the small intestine. It is introduced endoscopically through the mouth and it creates a barrier between food and the wall of the intestine, and also delays the mixing of the digestive enzymes with the food. It is believed that preventing food from coming into contact with the intestinal wall, and delaying digestion until farther down the intestine, alters the activation of hormonal signals that originate in the intestine. This creates a metabolic effect that is similar to Roux-en-Y gastric bypass surgery, resulting in significant weight loss, and resolution of type2 diabetes.

The advantages are obvious, being an endoscopic procedure, it minimizes morbidities and mortality related to traditional surgery. Other benefits are that it can be done as a daycare procedure, is reversible and has less cost. It does result in glycaemic control in type2 diabetes and also causes weight loss.

4. *TOGA (Transoral Gastroplasty)*

Fig 4: Endobarrier Device



Fig 5: Endobarrier Deployed In Small Intestine



The TOGA procedure is an incision free treatment using a set of flexible staplers, introduced into the mouth and esophagus, to create a four inch tube or sleeve in the stomach. TOGA is similar to vertical banded gastroplasty bariatric surgery. The small part of the stomach is stapled from the rest of the stomach, and this restrictive pouch allows food to drop down slowly to the rest of the stomach, to begin the digestive process. The pouch catches the food as it enters the stomach, and gives the patient a feeling of fullness after eating less. Compared to other gastric bypass weight loss surgery, in TOGA, none of the small intestines or other organs are changed.

The TOGA system for transoral gastroplasty is being developed by Satiety, Inc. and clinical trials with this device has shown upto 40% loss of excess body weights of patients after one year.

TOGA is less risky and painful than traditional gastric bypass surgery, as, if the staples fail, the stomach opens into its original shape with no risk of leakage. Long term benefits and risks of TOGA are yet to be established, but the role seems to be promising as evident in clinical trials, and maybe available in clinical practice once approved by FDA.

5. POSE (Primary Obesity Surgery, Endolumenal)

POSE serves the same basic purpose and results as the TOGA. POSE has been developed by USGI, Medical. The POSE procedure is performed by using a small flexible endoscope and the Incisionless Operating Platform (IOP). The scope and the IOP instruments are inserted through the mouth into the stomach, the same way as a standard endoscope. Once into the stomach, the surgeon uses surgical tools to grasp the stomach tissue and deploy suture anchors to create multiple tissue folds in the stomach wall to reduce its volume capacity. This leads to the feel accelerated fullness with satiation of hunger helping to eat less. The procedure is performed under general anesthesia, but patients can get it done on a weekend on Friday, and be back to work on Monday.

The IOP used in this procedure is anticipated to provide flexibility to surgeons sufficient to address a wide variety of procedural needs, making the use of incisionless surgery the next wave in minimally invasive surgery.

III. LESS (Laparo-endoscopic Single site Surgery)

There is an increased demand for scarless surgery and the laparoscopic surgeons will have to embrace this new challenge despite the learning curve that exists for such procedures. LESS i.e. Laparo-endoscopic single site surgery is performed by a single incision in the umbilicus, or in extraumbilical sites. Umbilicus is already a scar, hence the surgery becomes scarless.

LESS is performed using several individual trocars or the multitrocar port through the umbilical incision. Care is to be taken that during the umbilical incision, the umbilical ring or the skin around the umbilicus should

not be cut as this would result in permanent deformity of the stomach. Patients with history of "previous" open operations present a challenge, as they tend to have extensive intraperitoneal adhesions that potentially make any laparoscopic operation difficult. However, LESS can be attempted in these cases also.

The challenges with LESS are that, freedom of the hands is relatively restricted which leads to clashing and banging of the instruments if the standard laparoscopic instruments are used. Fixed port at umbilicus potentially creates a long distance to the surgical site, hence longer instruments are required. New instruments continue to develop to accommodate the needs for a paradigm shift to LESS.

LESS has been successfully done for cholecystectomy. Other LESS procedures reported are LESS donor nephrectomy, LESS bariatric procedure, and LESS paediatric procedures.

The concern of increased incidence of incisional hernia due to 12-15 mm port in

umbilicus exists, and studies need to evaluate it. Also what needs to be remembered is that appropriate imaging technology needs to be available to do the procedure safely.

To conclude, diagnostic potentials for endoscopy have been established and there is a shift to diagnosis by non-interventional techniques like virtual endoscopy and MRCP, which the radiologists are developing enthusiastically. What then becomes the focus in endoscopy is its therapeutic potentials. Most of the complications in endoscopy are also related to the therapeutic procedures, and many a times need a surgical intervention, and there, the role of surgeon is undisputed. Looking at these aspects, it is time for surgeons to get them involved with endoscopy and give these developing minimally invasive procedures a boost, with their surgical knowledge and techniques. Timely recognition of complications, and early surgical intervention by surgeon as primary endoscopist, would avoid the detrimental effects caused by delay in referral by a medical gastroenterologist.