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Techniques in
Gastrointestinal
Endoscopy

Snares, Knives, and Scissors

Todd H. Baron, MD, FACP

Polyp snares and needle knives are invaluable tools for the performance of therapeutic endoscopy. Endoscopic scissors, though uncommonly used, are useful in very selected circumstances. Colonic polypectomy is one of the most commonly performed therapeutic endoscopic procedures. Needle knives are used most commonly for biliary cannulation, but are adaptable to a range of therapeutic interventions.
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A variety of devices are available for endoscopic use that allows removal of tissue or cut tissue (incisions). This chapter will review endoscopic snares, knives, and scissors and their applications in gastrointestinal endoscopy.

Snares

Device Description

A variety of snares are available from several manufacturers. Snares may be reusable or disposable (single-use only). Snares differ in configuration, size, wire diameter, and ability to rotate. The most common shapes are oval, crescent, diamond, and hexagonal (Fig. 1). Available sizes include mini, small, medium, and large snares.

Mini-snares are most commonly used for removal of very small polyps. The advantage is their maneuverability and lack of deformity. Mini-snares will usually open fully, even when working in a limited space. Although large snares (which open as large as 5 cm) are useful for snaring large polyps, they can be cumbersome to use. Thus, in cases of piecemeal resection, it may still be easier to use a smaller snare on a large polyp.

Snare wire thickness affects the speed of electrocoagulation. Selection of a snare based on the thickness of the wire is important as they do operate differently. Most snare wires used for polypectomy of a pedunculated polyp are relatively thick, which minimizes the risk of cheese-wiring, whereas the larger contact area favors coagulation. Thin wire loops are commonly used for EMR and are preferred by some physicians for performing snare ampullectomy. In the latter indication, a lower current setting should be used and/or considerable care in closure to avoid cutting too rapidly, before full coagulation occurs.

Snares with barbed-type edges are available and may be useful when a standard snare fails to grasp onto tissue.

Regardless of the type of snare used, it is important to use caution when using a snare that one is unfamiliar with.

Device Operation

All snares use a handle mechanism that allows the snare to be opened and closed. One way to improve the safety of polypectomy is to mark the snare handle with a pencil or indelible pen at the point that the snare is just closed to the tip of the outer sheath. This allows the operator to identify when the snare closure occurs in relation to the polypectomy. This step is much more important when larger stalks are being cut to prevent mechanical severing of the polyp without adequate electrocoagulation. Finally, this step allows the operator to determine whether the stalk is larger than realized or if tissue has become entrapped.

Polypectomy Using a Forward-Viewing Endoscope

Positioning of the polyp in the six o'clock position of the endoscopic visual field by rotation of the colonoscope makes it easier to snare polyps because the snare enters the field at this orientation (Fig. 2).[1] The snare is then positioned over the polyp, which is facilitated by downward tip deflection of the colonoscope. Sessile polyps are easier to grasp when suction is applied. This reduces the flattening effect that occurs with insufflation and allows the polyp to be suctioned into the snare. Another technique is to "backhand" the polyp by pushing the snare loop backwards over the polyp head (Fig. 3). Yet another technique is to place the snare to one side or other of the polyp head and then swing it over the polyp by appropriate movements of the instrument.

As the snare is closed around the polyp, the endoscopist should advance the snare sheath against the stalk. This en-

Division of Gastroenterology and Hepatology, Department of Medicine, Mayo Clinic College of Medicine, Rochester, MN.
Address reprint requests to Todd H. Baron, MD, FACP, 200 First Street SW, Charlton 8, Rochester, MN 55905. E-mail: baron.todd@mayo.edu

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Figure 1 Available polypectomy snares. Common shapes include oval, crescent and hexagonal. (Reprinted with permission from Ginsberg G, et al: Clinical Gastrointestinal Endoscopy. Philadelphia, Elsevier Saunders, 2005.) (Color version of figure is available online.)

sures that closing the loop will tighten it exactly at the same point. If the sheath is not advanced, loop closure by the assistant will tend to move or even pull the wire off the polyp unless the endoscopist simultaneously advances the sheath. The snare loop should be closed gently, to the mark or by the feel of resistance by the assistant.

Polypectomy Using a Side-Viewing Endoscope

Side viewing endoscopes are used for polypectomy of the major papilla (ampullectomy or papillectomy; Fig. 4).[2] It is more difficult to perform from both the endoscopist and assistant perspectives because the snare must be brought into the visual field with the elevator. When the elevator is closed, it binds the sheath and makes it more difficult for the assistant to open and close the snare with controlled movements. It also makes it more difficult to advance the snare as it is being closed (see standard polypectomy) to maintain the snare in the same position. To pass the snare into the visual field, the elevator is initially kept closed while the snare is introduced. When the snare cannot be passed further, the elevator is closed to bring the snare into the visual field.

Types of Polypectomy

There are two ways polypectomy can be performed: with electrocautery (hot snare polypectomy) and without electrocautery (cold snare technique).

Hot Snare Polypectomy

The settings for electrocautery vary depending on the size of the polyp and the location in the colon. In general, lower current settings should be used when performing polypectomy in the right colon because of the thinness of the wall. For polyps with large, potentially vascular stalks, higher wattage settings may be required and more coagulation (blended current) should be used. It is important to keep the tip of the snare away from the opposite colon wall, though this is unlikely to cause damage unless prolonged contact occurs. I prefer to gently retract the snare away from the wall, either by withdrawing the endoscope or snare, or rotating the endoscope away from the colonic wall.

Cold Snare Polypectomy

Cold snare polypectomy is becoming more common for the resection of small sessile polyps (≤ 6-7 mm) as an alternative to hot-biopsy technique.[1] The latter is associated with delayed bleeding as an ulcer forms at the point of cautery-induced injury. Cold snare technique is associated with low rates of bleeding and may be preferable to cautery in patients with a higher risk of delayed bleeding. Additionally, it is safe to use in patients with cardiac pacemakers and defibrillators. The principles of grasping the polyp are identical to those of electrocautery. Even piecemeal resection of still relatively small sessile polyps can be performed, if needed. In the event that the polyp does not sever with cold-snare technique, the polyp can be released and a smaller portion grasped. Alternatively, electrocautery can be applied.

Knives

Device Description

At the present time, all knives used during gastrointestinal endoscopy are needle knives. Needle knives are essentially "naked" diathermy wires (Fig. 5). Similar to polypectomy snares, a variety of needle knives are available, though the main difference within each class of knife is the thickness of the cutting wire.

Standard Needle Knife

The standard needle knife is shown in Fig. 5 (upper left). The diathermy wire is inside a sheath and is exposed by a handle mechanism. Electrocautery is applied. The main concern with using this type of needle knife is the fact that it is a

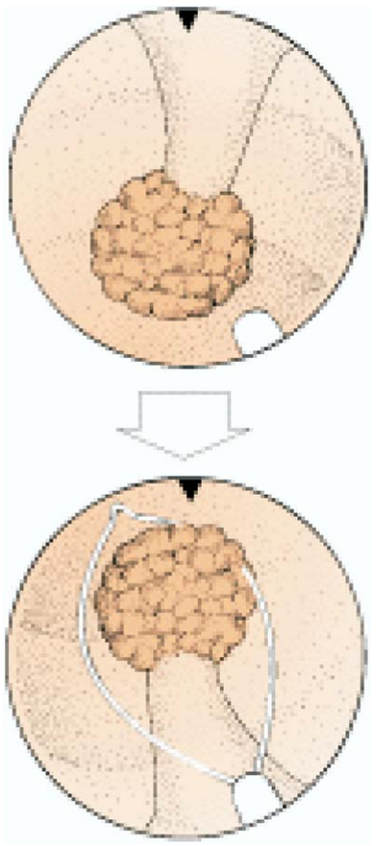

Figure 2 Rotation of the endoscope to place the polyp in the 5 to 6 o'clock position. (Reprinted with permission from Cotton PB, Williams CB: Polypectomy Techniques, in Practical Gastrointestinal Endoscopy (ed 5), 2004.) (Color version of figure is available online.)

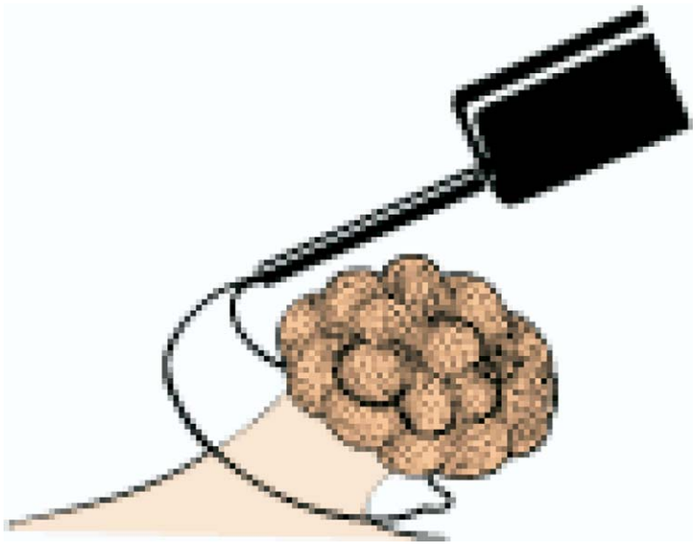

Figure 3 The backhanded technique of placing the snare over a polyp. (Reprinted with permission from Cotton PB, Williams CB: Polypectomy Techniques, in Practical Gastrointestinal Endoscopy (ed 5), 2004.) (Color version of figure is available online.)

free-hand technique, which is associated with a high risk of perforation. Thicker wires produce less cut and more coagulation. When using needle knives, the newer, controlled electrosurgical generators should be used whenever possible to reduce the risk of perforation.

Ball Tip (Insulated Tip) Needle Knife

The ball tip needle knife has an insulated, ceramic tip (Fig. 5, upper right), which permits cutting only at the side of the knife. This allows more control and prevents inadvertent contact of the tip from conducting cautery, thus potentially minimizing perforation.

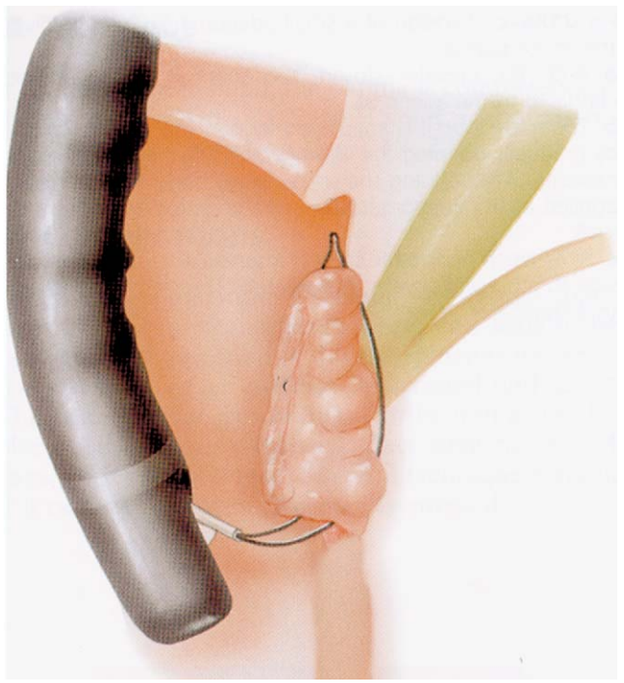

Figure 4 Ampullectomy using a side-viewing endoscope. (Reprinted with permission from Soehendra N, et al: Therapeutic Endoscopy: Color Atlas of Operative Techniques for The Gastrointestinal Tract. Stuttgart; New York, Thieme, 2005, p 171.) (Color version of figure is available online.)

Hook Tip Knife

Hook tip needle knives are designed to allow dissection of the submucosa for the removal of large mucosal lesions (Fig. 5, bottom). The tip of the needle knife has a 90-degree bend. The length of the hook is 1.3 mm and the arm is 5 mm. The handle is rotatable.

Device Operation

The key to using a needle-knife is precise movement. This is usually accomplished by moving the endoscope tip rather than the knife itself. When using a side-viewing endoscope, the elevator is used to move the needle knife in the inferior/superior axis.

Choice of Instrument

A noninsulated tip is used for precut techniques (see below), whereas for electroincision of esophageal strictures, the insulated tip needle knife is preferable. Additionally, for deep

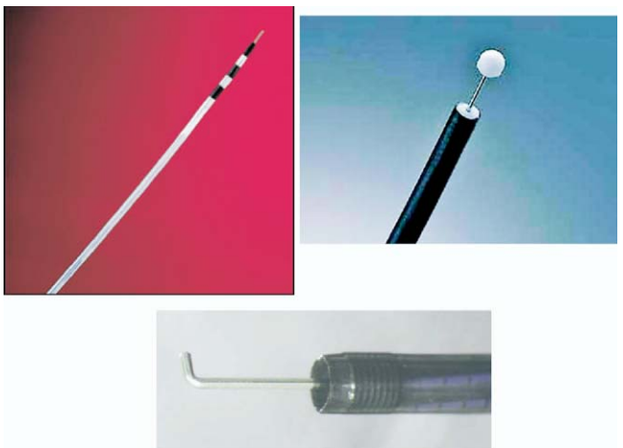

Figure 5 Needle knives. (Top left) Standard. (Image courtesy of Wilson-Cook.) (Top right) Insulated tip. (Image courtesy of Olympus.) (Bottom) Hook. (Reprinted with permission from Oyama T, et al: Endoscopic submucosal dissection of early esophageal cancer. Clin Gastroenterol Hepatol 3:S67-S70, 2005 (Suppl 1).)

submucosal resection, the insulated tip is preferable so as to not perforate the gastrointestinal wall.

Clinical Applications

The clinical applications of needle knives are greater than any other endoscopic accessory. Each application has inherent indications and limitations.

Needle Knife Sphincterotomy

Needle knife sphincterotomy is usually performed for biliary access as a type of precut sphincterotomy. In addition, there are several ways to perform needle-knife precut sphincterotomy.[3] None of these methods are standardized. One method is referred to as the precut fistulotomy technique in which the suprapapillary portion of the bile duct is entered. This way the pancreatic duct orifice is avoided. Some endoscopists prefer to cut from inferior to superior, whereas others prefer the opposite direction. The key is to avoid "lunging motions" by using sweeping motions beginning superficially and progressing deeper.

Another way of needle knife sphincterotomy is to begin at the papillary orifice and cut cephalad in the direction of the bile duct. The key here is to lift the superior portion of the papilla to "unroof" the bile duct.

Two alternatives to needle knife precut are: (1) the use of a precut sphincterotome and (2) transseptal pancreatic precut sphincterotomy. In the first of these, a precut sphincterotome is utilized and placed into the papilla. The cut is directed toward the bile duct. The second involves cannulating the pancreatic duct and cutting across the septum in the direction of the bile duct. Each of these can potentially produce edema at the level of the papilla, with resulting pancreatitis.

Another use of a needle knife is to perform biliary sphincterotomy in patients with Billroth II anatomy.[4] In Billroth II anatomy, the endoscopic view is rotated 180° from the usual view obtained during ERCP. Thus, a standard sphincterotome will orient in the wrong direction, with potentially disastrous results. An alternative is to place a biliary stent. The needle knife is then used to cut the sphincter using the stent as a guide. The stent is then removed, if not needed.

Zenker's Diverticulotomy

Using this technique, the septum of the Zenker's diverticulum is severed to improve dysphagia. A nasogastric tube is placed into the esophagus to define the landmarks of the septum. A needle knife is used to divide the septum using electrocautery. Some endoscopists prefer to use a fitted hood similar to the cap used for endoscopic mucosal resection.[5] The results of this technique are comparable to surgically performed diverticulotomy, although no comparative studies exist. Advantages to the flexible endoscopic approach are the avoidance of general anesthesia, the lack of need for an operating room, and potential to be performed as an outpatient.

Removal of Pedunculated Polyps

Large pedunculated polyps can be difficult to snare resect if the head of the polyp is so large that it precludes encircling the stalk. One alternative is to use the needle knife to section the stalk.[6] Because of the concern for bleeding from the stalk, clips can be applied to the base of the stalk. The needle knife is then used to freehand cut the stalk. In this situation, the insulated tip needle knife is advantageous. The side of the knife is used to cut the stalk. Alternatives to this approach are to use a snare to piecemeal resect the head of the polyp until it is reduced enough in size to encircle the stalk. The disadvantage of the latter approach is that an intact specimen is not available for histopathology.

Needle Knife Dissection and Removal of Cancer

The removal of cancer is performed commonly outside the US because of the intensive screening and discovery of early cancers in the upper gastrointestinal tract (esophagus and stomach).[7] The technique is performed by creating a submucosal tissue plane. After initial injection of a submucosal fluid cushion, a mucosal incision is made using the back side of the hook knife. The mucosa is hooked with the hook knife and the submucosa is dissected, also with the hook knife.

Needle Knife Dissection and Removal of Submucosal Tumors

Similar to the endoscopic resection of early cancer, en bloc enucleation of submucosal lesions has been described.[8] Injection of a saline solution into the submucosa immediately above (on top) of the tumor detaches it from the overlying mucosa. A 3- to 5-mm diameter hole is created at the injection site by using a conventional needle knife. Through this opening, an insulated tip needle knife is introduced, and a longitudinal incision of the overlying mucosa is made by using blended current. This exposes the surface of the tumor. Lateral dissection is then performed by using the insulated tip needle knife. Once the mucosal layer is completely separated from the tumor, the underlying muscularis propria is dissected away from the tumor by using the insulated tip needle knife. After completely exposing the tumor, it is excised at its base by using a standard polypectomy snare and electrosurgical current.

Needle Knife Recanalization of Intraluminal Duodenal Diverticula

Intraluminal duodenal diverticula are rare. Symptoms most commonly occur from obstruction. Endoscopic incision into the sac using a needle knife can alleviate the obstruction.[9]

Needle Knife Recanalization of Schatzki's Ring, Pyloric Stenosis, Refractory Strictures (Stricturoplasty)

Needle knife electroincision of strictures was first applied to refractory Schatzki's rings,[10] but this technique has subsequently been applied to other areas of the gastrointestinal tract. Areas of electroincision have included the esophagus in the setting of refractory esophagogastric anastomotic strictures,[11] the colon for refractory colocolonic anastomotic strictures,[12,13] and most recently the pylorus for the treatment of congenital pyloric stenosis.[14] The technique is similar for all of these areas. Radial cuts are made into the narrowing (Fig. 6). The standard needle knife has been applied most often, though if the stricture is very short, the insulated tip needle knife is preferable. I perform aggressive dilation at the same sitting after the electroincision.

Transmural Drainage of Pancreatic Pseudocysts

Endoscopic drainage of pancreatic pseudocysts can be achieved by puncturing through the gastric or duodenal wall (transmural entry) into the pseudocyst followed by dilation of the tract and passage of stents into the cavity.[15] The initial

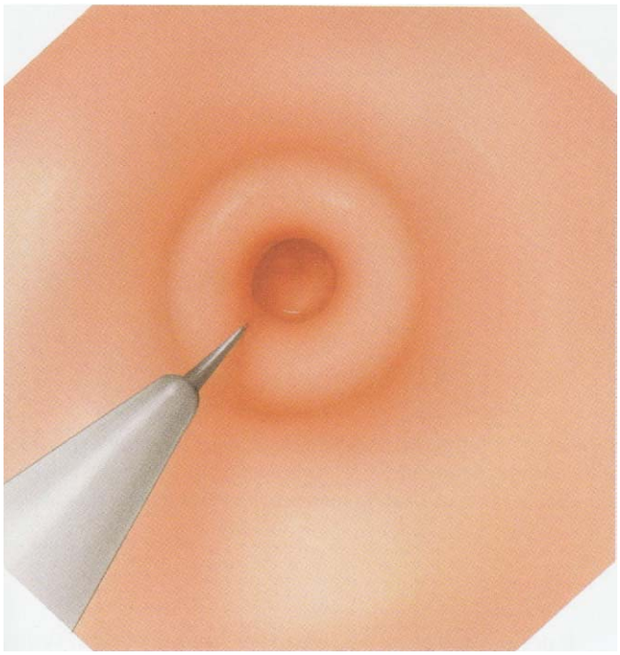

Figure 6 Electroincision of a fibrotic ring using a standard needle knife. (Reprinted with permission from Soehendra N, et al: Therapeutic Endoscopy: Color Atlas of Operative Techniques for The Gastrointestinal Tract. Stuttgart; New York, Thieme, 2005, p 21.) (Color version of figure is available online.)

puncture is made into the area impression of the cyst into the lumen of the stomach or duodenum, or under endoscopic ultrasound visualization. One of the methods of puncture is the use of a needle knife. Electrocautery is applied as the needle is directed into the wall. A larger diameter needle knife may potentially decrease the risk of bleeding by providing more coagulation than a smaller diameter needle. When I use this approach, I prefer to use the blended current that provides the most coagulation.

Endoscopic Scissors

Device Description and Operation

Endoscopic scissors are the newest addition to the endoscopists' armamentarium. Simple mechanical endoscopic suture scissors have been available for some time, and handle operation of the device is similar to opening and closing of biopsy forceps. These have been used to remove surgically placed sutures that have caused excessive granulation tissue. Since then, mechanical scissors have been developed for ERCP use. More recently, scissors that utilize electrocoagulation have been developed.

Clinical Applications

Suture Removal

Intraluminal sutures after surgical procedures have been the cause in rare cases of obstruction and bleeding. Additionally, there are reports of surgical drains inadvertently sutured to structures of the abdominal wall or lumen that have been removed after endoscopic suture removal using scissors. The technique of endoscopic suture removal is similar to that used with suture removal outside the body. The suture is cut adjacent to the knot rather than cutting the knot itself.

Biliary Cannulation

As an alternative to precut using needle knife techniques, an endoscopic scissor has been developed to allow entry into the bile duct when routine cannulation techniques fail.[16] The lower blade of the specially designed scissors is fixed; the upper is activated at the proximal end by a sliding handle fastened to a wire. The lower blade is inserted into the papillary orifice similar to cannulation of the common bile duct using a catheter. A cut is then made in the presumed direction of the bile duct in the 11 o'clock position. The potential advantages to this technique over needle knife precut are improved control with less likelihood of perforation and the lower risk of bleeding.

Expandable Metal Stent Removal/Trimming

There is one case report of endoscopic suture scissors for the removal and trimming of an embedded, uncovered expandable metal biliary stent composed of stainless steel.[17] This is an alternative to stent removal using forceps, which can be difficult, if not impossible. I have used this technique for trimming a colonic stent in the very distal rectum.

Cutting of Esophageal Strictures

There is one case report of successful cutting of a refractory benign esophageal stricture of the proximal esophagus using suture scissors.[18] The stricture was membranous and short. This technique is unlikely to be effective for longer, more fibrotic strictures. This technique may be a useful alternative to electroincision in selected cases.

Removal of Superficial Invasive Cancer

There is one report of a novel endoscopic scissor that uses electrocautery in which a superficial gastric cancer was resected.[19] The scissors served to facilitate resection using a double channel endoscope and other endoscopic resection techniques. This technique is not recommended at this time.

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