



## Endoscopic submucosal dissection and endoscopic mucosal resection methods for the removal of large sessile polyps



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### A B S T R A C T

In expert hands, endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) methods can successfully and definitively treat large sessile polyps, thus, eliminating the need for segmental colectomy. The goal should be to utilize ESD whenever feasible as it yields an en bloc specimen. ESD methods can also be used to definitively treat superficial invasive colorectal cancers, which have a very low chance of lymph node involvement.

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### Introduction

In the past 20 years, gastroenterologists, mainly in Japan, have developed and introduced advanced endoscopic methods for the removal of large sessile colorectal polyps. Endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) are techniques that, if successfully completed, obviate the need for a segmental bowel resection that, in the United States, is currently the principal means by which large sessile polyps are treated. Avoidance of bowel resection in patients with benign neoplasms reduces the cost and morbidity of treatment. EMR removes large lesions in a piecemeal manner, whereas the ESD method permits en bloc excision of a neoplasm that allows for assessment of the excision margins and a more comprehensive pathologic evaluation. EMR and ESD were developed for use in the stomach as a means of dealing with early gastric malignancies and dysplastic lesions, which are common problems in Japan. After gaining much experience with ESD in the stomach, a subset of Japanese gastroenterologists began using these methods to remove large sessile adenomas in the large bowel. ESD methods are now the gold standard in Japan and the Far East in regards to the removal of these lesions. Although not the topic of this article, ESD and EMR methods have also been successfully used by experts in Japan and elsewhere in the Far East to definitively treat superficial colorectal cancers.

Western physicians and surgeons, with few exceptions, have not developed the necessary skill set for ESD mainly because of the low incidence of gastric cancer in the West. Presently, there is a small (but growing) number of GI MD's in the United States and

Europe who are learning advanced EMR and ESD methods and are employing these techniques; however, as mentioned above, the great majority of large benign colorectal neoplasms in the United States are removed via a formal segmental bowel resection. However, over the past decade a small but growing number of colorectal and general surgeons in the United States, in an effort to reduce the number of colorectal resections being done for benign lesions, have developed combined and simultaneous colonoscopic and laparoscopic adenoma resection methods (polyp-bearing colon segment manipulated with laparoscopic instruments to facilitate endoscopic piecemeal polypectomy). Finally, some surgeons are performing ESD in the large bowel in the operating room in conjunction with a post colonoscopy laparoscopy to assess and repair the bowel wall, if necessary, or to perform a segmental bowel resection if the polypectomy attempt fails. The authors fall into the latter category. It is the authors opinion that the ultimate goal is to remove large benign lesions via ESD in the endoscopy suite, however, until the ESD method has been mastered, the OR setting is the best setting for these procedures. This article will address the EMR and ESD methods in general as well as present a safe means by which surgical endoscopists might initially learn and introduce these methods into their practice.

### Submucosal lift

Critical to ESD and all but one of the EMR methods is the submucosal lift. Injection of saline or other solution into the submucosa results in the elevation or “lifting” of the overlying mucosa. The submucosal layer is capable of impressive expansion, which increases the distance between the muscularis propria and the mucosal layer. The mucosal lift creates the space within which

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the polypectomy can be performed with an electrosurgical snare or needle knife. The greater the gap between the outer muscularis propria and the mucosa, the lower the chances of muscularis propria injury and perforation. Without a lift, ESD should not be attempted. Similarly, the great majority of gastroenterologists who deal with the largest polyps are reluctant to attempt a complex EMR if a reasonable lift cannot be achieved.

Failure of part or all of a sessile lesion to elevate when injected is considered by many experts to be a contraindication to ESD. Failure to lift may be the result of invasion of a malignant tumor through the submucosa into the muscularis propria (T-2 lesion). In this case, colonoscopic removal of the lesion is contraindicated; instead, an oncologic segmental bowel resection is required. However, a polyp also may not lift because of scarring from prior endoscopic biopsies or polypectomy attempts with a snare. Scarring in the bowel wall from prior inflammation or any process that results in a desmoplastic reaction or scarring (Crohn's disease, radiation, colitis, etc.) will prevent the mucosa from lifting. In Japan, ESD experts strongly recommend that large polyps, when encountered, not be biopsied or partially snared in order to avoid scarring that will prevent the polyp from fully lifting. In the United States, unfortunately, the vast majority of large polyps are either partially snared or biopsied when found this practice results in non-lifting lesions which, in most endoscopists hands, eliminates ESD as a removal option.

#### *Lifting solutions*

The duration of the lift varies depending on what solution is injected. The longer the duration, the better. The mean duration of a saline lift is between 2 and 3 min, whereas if epinephrine is added it is over 3 min. A variety of other solutions has been assessed as lifting agents including 50% dextrose (mean lift duration 4.7 min), hydroxypropylmethylcellulose (36 min), 25% albumin, 10% glycerol and 5% fructose in saline, 1% sodium hyaluronate (22.2 min), and hypromellose solution.<sup>8,9</sup>

In Japan, the majority of endoscopists utilize a hyaluronic acid solution often in conjunction with a glycerol solution; however, it is important to note that both solutions are commercially available in Japan, but not in the United States. In the United States, one of the other solutions mentioned is being utilized. Some of the solutions (e.g., D-50 and GONAK) are very viscous and are very difficult to inject via the long sclerotherapy catheter. Currently, the authors are using 25% albumin and have been satisfied with the results. Hopefully, soon, there will be a large market in the United States that a company(s) will bring a lifting solution to market.

#### **EMR**

EMR utilizes submucosal lift and application of a hot snare(s) to remove large polyps, whereas for polyps greater than 2 cm multiple applications and piecemeal resection are necessary, and for polyps 2 cm in size or smaller en bloc resection can be accomplished in a significant percentage of cases, in expert hands.<sup>16</sup> This method requires a sclerotherapy catheter, lifting solution, polypectomy snare, and possibly endoscopic clips. EMR does not require a high-frequency energy source (although if available it should be used) or needle knife. With few exceptions, EMR takes less time than ESD. Moreover, the skill set needed for EMR is an extension of standard colonoscopic methods and not as difficult to acquire as those needed for ESD. A major disadvantage of EMR is that it is not possible to evaluate the polypectomy margins because the lesion is removed in pieces.

An important basic principle of EMR is that the goal should be to fully remove the polyp at the initial attempt. Removing only a

part of a large polyp will likely result in scarring that will prevent full lifting of the residual polyp, when the next colonoscopic attempt is made.

The potential complications are bleeding and perforation (as discussed in the Results section). The majority of bleeding issues occur at the time of the procedure or within the first 24 h. As is the case for ESD, endoclips can be used to close mucosal gaps and to stop persistent bleeding. The four principal EMR methods are briefly described below.<sup>1,15–17</sup>

#### *Inject and cut method*

This is probably the most commonly used EMR method. This method calls for a submucosal lift followed by snare application to a portion of the polyp and then excision of the ensnared tissue. This is repeated until the polyp has been fully removed. When completed, the polyp fragments are placed in a basket or net and then removed. The saline lift facilitates the snaring of most polyps except those that are very flat. It can be difficult to fully remove some polyps using this method. There are a variety of different snares (larger, firmer, hexagonal, crescent, or asymmetric) that can be used to facilitate polypectomy. If needed, a cold biopsy forceps can be used to destroy the residual polyp if it cannot be snared. Coagulating the remaining polyp with a needle knife or partially extended snare is another option.

#### *Inject, lift, and cut method*

This method requires a double-channel colonoscope. After the submucosal lift is established a snare is inserted via one of the working channels and then opened over the lesion. A cold biopsy forceps or another snare inserted via the second channel is then used to grasp the polyp beneath the opened snare. The scope tip is then deflected upwards, which lifts the grasped part of the polyp into the lumen and creates a raised lesion that can more easily be snared. Next, the snare is closed around as much of the polyp as possible after which current is applied to the snare and the entrapped part of the polyp excised. These steps are repeated until the polyp has been fully removed. A downside to the use of the double-channel scope is that it is less flexible and maneuverable owing to its larger diameter and greater stiffness. This limits the ability of the endoscopist to approach the polyp from the proximal and lateral aspects.

#### *Lift, Suction, and Cut*

This is a method that is used predominantly in the stomach in association with a submucosal lift. A special plastic cap (scope diameter specific) with a groove on the inner surface close to the cap tip is placed on the endoscope. The snare is prepositioned inside the cap in a partly open position such that it sits in the above mentioned groove. This is done by applying and maintaining light suction to the mucosa, which creates a seal between cap and mucosa but does not pull the mucosa into the cap. The snare is then partly opened that, in the closed space, pushes the snare into the cap groove after which the suction is released. The scope is then positioned over the polyp and moderate-to-high vacuum applied such that a portion of the polyp is then pulled into the cap. Next, the snare is closed, encircling the entrapped tissue. While maintaining a firm grasp on the tissue, the suction is released and the snare is pushed further into the scope so that the ensnared pseudopolyp is not immediately adjacent to the scope tip and cap. Power is then applied, and the snare closed in the usual manner. This is then repeated until the lesion has been fully removed. Because it is difficult to control the amount of tissue suctioned into

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