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Indications, Knives, and Electric Current: What's the Best?

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Endoscopic submucosal dissection (ESD) was developed to overcome the limitations of conventional endoscopic mucosal resection (EMR), and ESD has been also applied for large colorectal neoplasms. Since colorectal ESD is still associated with higher perforation rate, a longer procedure time, and increased technical difficulty, the indications should be strictly considered. Generally, colorectal tumors without deep submucosal invasion or minimal possibility of lymph node metastasis, for which en bloc resection using conventional EMR is difficult, are good candidates for colorectal ESD. The ideal knife for colorectal ESD should avoid making perforations but can make a clean cut of optimal depth at one time. The ideal current for ESD differs depending on the procedure used, the surgical devices used, the tissue to be dissected, and the operator's preference. Application of the optimal indications and improvements in the technical skill and surgical devices are required for easier and safer colorectal ESD.

Key Words: Colonoscopy; Colorectal neoplasms; Endoscopic submucosal dissection

INTRODUCTION

Endoscopic submucosal dissection (ESD) was developed to overcome the limitations of conventional endoscopic mucosal resection (EMR). ESD has been also applied for large colorectal neoplasms, and the complete *en bloc* resection rate of ESD for colorectal tumors is as high as 71% to 98% in some single-center studies.[1-3]

However, colorectal ESD is still associated with higher perforation rates, a longer procedure time, and increased technical difficulty. Thus, establishing the optimal indications for colorectal ESD and selecting proper surgical instruments and electric currents to perform this procedure are very important to minimize the complications associated with the procedure.

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INDICATIONS FOR COLORECTAL ESD

Endoscopy cannot treat metastatic lymph nodes. Thus, ESD should be limited to colorectal tumors with very low risk of node metastasis. Conversely, without deep submucosal invasion, lymph node metastasis rarely occurs in colorectal tumors,[4,5] and those tumors can be treated with local excision, such as EMR or ESD. While conventional EMR is inadequate for the en bloc resection of flat lesions, especially those larger than 20 mm, due to incomplete resection and recurrence, ESD can be a good treatment option for large colorectal tumors without deep submucosal invasion.

According to the announcements of the Korean Ministry of Health and Welfare, colorectal ESD should be applied to early colorectal cancers without lymph node metastasis, laterally spreading tumors (LST) larger than 20 mm, subepithelial tumors, and fibrosed tumors. The Japanese Colorectal ESD Standardization Implementation Working Group[6] also reported indications for ESD in the colorectum: a tumor for which the use of a snare EMR for en bloc resection is difficult (a non-granular LST, especially the pseudo-depressed type); a tumor with a type V_I pit pattern; a shallow infiltrating submucosal carcinoma; a large depressed tumor; a large elevated and likely malignant lesion; a lesions with fibrosis due to biopsy or peristalsis; a sporadic localized lesion in chronic inflammation, such as ulcerative colitis; and local residual carcinoma

after EMR.

Both the Korean and Japanese indications mainly consider the possibility of lymph node metastasis, the depth of invasion, the size and gross type, and the presence of fibrosis. However, it is not always easy to predict lymph node metastasis, submucosal invasion, or fibrosis until the final pathology has been obtained. Thus, a multimodal approach (analysis of gross findings, pit patterns by chromoscopy, microvascular patterns by narrow-band imaging, and endoscopic ultrasonography) is frequently required to evaluate whether colorectal ESD is indicated for tumor treatment.

KNIVES FOR COLORECTAL ESD

Since the colorectal wall is much thinner than the gastric wall, the risk of perforation (2.3% to 20.3%)[1-3,7] is much higher in colorectal ESD than in gastric ESD. Knives for colorectal ESD should be flexible since the colon is tortuous and wrinkled, and precutting and submucosal dissection should be performed frequently while bending the tip of the endoscope. Knives used for colorectal ESD should not make a deep cut and should avoid making perforations; a good cut should be achieved not only when pushing the knife forward but also when pulling the knife backward.

The contact area is one of the most important factors determining the characteristics of a knife. A knife with a smaller contact area usually produces a deep cut because it causes a higher current density. Fig. 1 shows frequently used electrosurgical knives for colorectal ESD and their electrosurgical characteristics.[8]

Flex knife (KD-630L; Olympus, Tokyo, Japan)

This knife is relatively flexible. The tip of the knife is not too sharp to make perforations easily. The tip of the outer sheath is relatively thick (buffer collar), which prevents the knife from descending deeply into the tissue. However, when the knife is perpendicular to the muscularis propia, dissection should be performed very carefully so as to avoid perforation. The exposed length of the knife can be adjusted. The Flex Knife is one of the most commonly used knives in colorectal ESD.

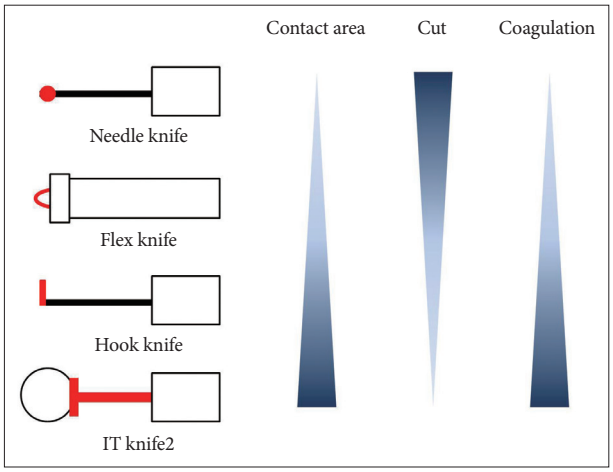

Fig. 1. Electrosurgical knives for colorectal endoscopic submucosal dissection. Gray represents contact area.[8]

The Fixed Flexible Snare (Kachoo Technology, Seoul, Korea) has a fixed snare-shaped scalpel and enables irrigation during dissection.

Hook knife (KD-620LR/QR; Olympus)

This knife is relatively safe because it makes a cut by hooking the tissue inside a transparent distal attachment. It can also provide a safer cut when the knife is perpendicular to the dissection plane or submucosal fibrosis is present. The elapsed time for ESD may be prolonged with this knife because it can cut only a small amount of tissue at a time and requires a hooking process.

Dual knife (KD-650Q/U; Olympus)

This knife has a knob-like tip that enables cutting not only when pushing the knife forward but also when pulling the knife backward. The length of the exposed tip can be adjusted to either 0.3 mm or 1.5 mm. The shorter tip was designed for marking and hemostasis, while the longer tip was designed for submucosal dissection. The Dual knife is recommendable for beginning operators because the length of the exposed tip is fixed and the dissection amount is relatively small.

IT knife2 (KD-611L; Olympus)

This knife consists of a ceramic sphere at the distal tip of the knife and three short electrodes at the proximal side of the sphere. These electrodes enable cutting of tissues at various angles. Since this knife can cut a relatively large amount of tissue at one time, perforation can occur. Thus, the IT knife2 is usually reserved for cutting a drooping flap at the final stage of ESD. Recently, a small-tipped IT knife (KD-Y0009; Olympus) was developed for colorectal and esophageal ESD.[9]

Others

The Flush knife (Fujinon, Tokyo, Japan) has a needle knife-like shape. However, the Flush knife has a blunter scalpel that can be used at various lengths and can provide irrigation and submucosal injection.

The B-knife (Zeon Medical, Tokyo, Japan) is characterized by its bipolarity. Since the electric current flows from the tip of the scalpel to the outer sheath, no counter-electrode plate is required.

The SB knife Jr. (Sumitomo Bakelite, Tokyo, Japan) is like a

small pair of scissors. All other parts of the knife except the blades are insulated to concentrate the electric current only on the blades.[10] The Clutch Cutter (Fujifilm, Tokyo, Japan) can also dissect tissue by grasping and cutting.[11] The abovementioned knives are not currently available in Korea.

ELECTRIC CURRENTS

During ESD, the electric impedance continuously changes since the area of contact also changes. Thus, the electric power from the electrosurgical unit should be controlled automatically. The optimal current for an ESD procedure differs depending on the procedure used (precut, submucosal dissection, or hemostasis), the surgical devices used (knives and hemostatic forceps), the tissue to be dissected (presence of fibrosis), and the operator's preference.

Endo cut is usually preferred for precutting and submucosal dissection. This current is characterized by alternatively applying the cut current and soft coagulation current.

Forced coagulation is the most common current used for conventional coagulation. Carbonation may accompany this current. This current can be used for trimming, which consists of an additional incision at the submucosal layer along the precut line, or submucosal dissection.

Swift coagulation is a continuous current similar to dry cut, but it has more of a coagulation effect. This current is usually used for submucosal dissection.

Soft coagulation is a low voltage current (<200 V) that coagulates adjacent tissues slowly. Minimal carbonation occurs. The current is usually used for bleeding control with hemostatic forceps.

CONCLUSIONS

Colorectal tumors without deep submucosal invasion, for which en bloc resection using conventional EMR is difficult, are good candidates for colorectal ESD. Nevertheless, the indications for colorectal ESD should be strictly considered because the procedure remains technically difficult and has related complications.

The ideal knife for colorectal ESD should avoid making perforations but can make a clean cut of optimal depth at one time not only when pushing the knife forward but also when pulling the knife backward. The optimal current for ESD differs depending on the procedure used, the surgical devices used, the tissue to be dissected, and the operator's preference. Improvements in the operator's skill and surgical devices are required for easier and safer colorectal ESD.

Conflicts of Interest

The author has no financial conflicts of interest.

REFERENCES

1. Saito Y, Uraoka T, Matsuda T, et al. Endoscopic treatment of large superficial colorectal tumors: a case series of 200 endoscopic submucosal dissections (with video). Gastrointest Endosc 2007;66:966-973.
2. Fujishiro M, Yahagi N, Kakushima N, et al. Outcomes of endoscopic submucosal dissection for colorectal epithelial neoplasms in 200 consecutive cases. Clin Gastroenterol Hepatol 2007;5:678-683.
3. Toyonaga T, Man-i M, Fujita T, et al. Retrospective study of technical aspects and complications of endoscopic submucosal dissection for laterally spreading tumors of the colorectum. Endoscopy 2010;42:714-722.
4. Kitajima K, Fujimori T, Fujii S, et al. Correlations between lymph node metastasis and depth of submucosal invasion in submucosal invasive colorectal carcinoma: a Japanese collaborative study. J Gastroenterol 2004;39:534-543.
5. Ueno H, Mochizuki H, Hashiguchi Y, et al. Risk factors for an adverse outcome in early invasive colorectal carcinoma. Gastroenterology 2004;127:385-394.
6. Tanaka S, Terasaki M, Kanao H, Oka S, Chayama K. Current status and future perspectives of endoscopic submucosal dissection for colorectal tumors. Dig Endosc 2012;24 Suppl 1:73-79.
7. Kim ES, Cho KB, Park KS, et al. Factors predictive of perforation during endoscopic submucosal dissection for the treatment of colorectal tumors. Endoscopy 2011;43:573-578.
8. Tanaka S. Basic Technique of Endoscopic Mucosal Resection and Endoscopic Submucosal Dissection for Colorectal Tumors: Knack, Pitfall, and Conclusive Evidence of Adjustment. Tokyo: Mejikaru Byusha; 2006.
9. Hotta K, Yamaguchi Y, Saito Y, Takao T, Ono H. Current opinions for endoscopic submucosal dissection for colorectal tumors from our experiences: indications, technical aspects and complications. Dig Endosc 2012;24 Suppl 1:110-116.
10. Homma K, Otaki Y, Sugawara M, Kobayashi M. Efficacy of novel SB knife Jr examined in a multicenter study on colorectal endoscopic submucosal dissection. Dig Endosc 2012;24 Suppl 1:117-120.
11. Akahoshi K, Akahane H, Motomura Y, et al. A new approach: endoscopic submucosal dissection using the Clutch Cutter(R) for early stage digestive tract tumors. Digestion 2012;85:80-84.