

Technical Note

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Characteristics and uses of IT knife nano

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Abstract

IT knife nano[®] (Olympus Medical Co., Tokyo, Japan) is a knife device specialized for esophageal and colorectal endoscopic submucosal dissection (ESD). The IT knife nano has a smaller insulated tip than that of the IT knife 2, making it easier to handle the submucosal layer in the colorectum. The disk behind the insulated tip is also smaller to reduce thermal damage to the muscle layer. Furthermore, the IT knife nano is considered to have more power for incision because the IT knife nano has a large amount of electric current at the blade compared to other devices. Therefore, the IT knife nano can resect a larger amount of submucosal layer tissue at once, enabling a faster and more reliable detachment of the submucosal dissection as well as a circumferential mucosal incision. When performing submucosal dissection using an IT knife nano, the knife should be moved from the outside to the inside. While in a difficult situation, moving the knife gradually from the center (inside) to the outside can help perform a safe colorectal ESD. The IT knife nano is considered an option for difficult situations, such as lesions with severe fibrosis, or when rapid submucosal dissection is required. We herein provided technical aspects of the IT knife nano in detail and compared it with other needle-type devices.

Keywords: Colorectal ESD, endoscopic submucosal dissection, technical tips

INTRODUCTION

Hosokawa *et al.*^[1] and Ono *et al.*^[2] originally developed the IT knife[®] (Olympus Medical Co., Tokyo, Japan) to perform gastric endoscopic submucosal dissection (ESD) more safely and more effectively compared to the needle-type devices. Subsequently, the IT knife nano[®] (Olympus Medical Co., Tokyo, Japan), specialized



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for esophageal and colorectal ESD, was developed by Ono and Yamaguchi. The IT knife nano has a smaller insulated tip, making it easier to handle the submucosal layer. The disk behind the insulated tip is also smaller to reduce thermal damage to the muscle layer. Many studies on colorectal ESD using IT knife nano have been reported^[3-5].

CHARACTERISTICS OF IT KNIFE NANO

The IT knife nano can make incisions and resect using an electric current at the blade, one of the unique features that separate it from the needle-type knives. A long blade of IT knife nano makes it possible to resect the connected tissue, which is in contact with the submucosal tissue to be dissected. The IT knife nano is considered to have more power for incision, resection, and coagulation than needle-type devices. This is because the IT knife nano has a large amount of electric current at the blade compared to other devices. However, needle-type devices concentrate the current energy at the top of the needle to increase the current density. Therefore, the IT knife nano can resect a larger amount of submucosal layer tissue at once, enabling a faster^[6] and more reliable detachment of the submucosal dissection.

STRUCTURE OF IT-KNIFE NANO

The IT-knife nano has an insulated tip of the blade. A small disk is equipped behind the insulated tip to increase the resection efficiency. This disk makes it possible for the IT knife nano to resect the submucosal layer using the back of the disk touching the connective tissue. However, it should be noted that damage to the muscle layer by the burn effect of the disk may occur when the distance between the disk and the muscle layer is close [Figure 1].

Therefore, we have used another version of the IT knife nano without a disk to resolve this issue. We used a special made-to-order IT knife nano without a disk for lesions with a narrow submucosal layer caused by fibrosis. This increases the electric current density and improves the resection ability of the blade. This device also makes it easier to slip into the submucosal layer and approach the blade to the submucosal tissue for resection, even if the surgical field is difficult due to fibrosis or other reasons. In addition, an insulated tip without a disk is suitable for resection in a narrow working space of the submucosa. To use a special made-to-order IT knife nano without a disk, requirements have to be met as follows: (1) expert endoscopists perform many colorectal ESDs in a tertiary center; and (2) many IT knife nanos (normal type) are used for colorectal ESD in the hospital. When a hospital matches these criteria, the hospital can order a specially made IT knife nano from the industry.

TECHNIQUES OF IT KNIFE NANO

The IT knife nano is mainly designed to be pulled for resection, whereas other needle-type devices are based on cutting in the pushing direction.

Therefore, when performing submucosal dissection using an IT knife nano, the knife should be moved from the outside to the inside [Figure 2].

The detailed technique is as follows:

First, the edge of the submucosal tissue is visualized, and the knife blade hooked onto that edge. Then, the scope is manipulated along the running of the muscle layer to resect the submucosal tissue. The moving knife direction then should be aimed at the middle of the submucosal layer, which has been raised and thickened by submucosal injection [Figure 3]. Next, submucosal dissection should be performed equally

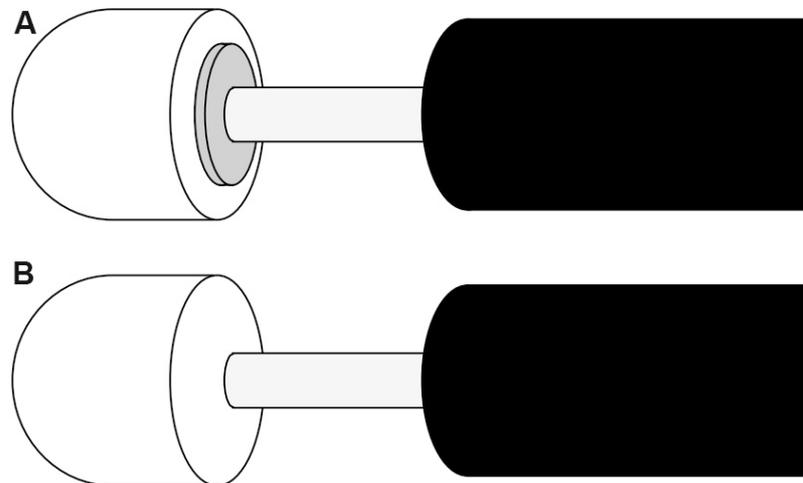


Figure 1. IT knife nano[®] with and without disk back of an insulated tip. (A) IT knife nano with a disk. A small disc is placed behind the insulated tip. (B) IT knife nano without disk. Only a blade is used for the submucosal dissection.

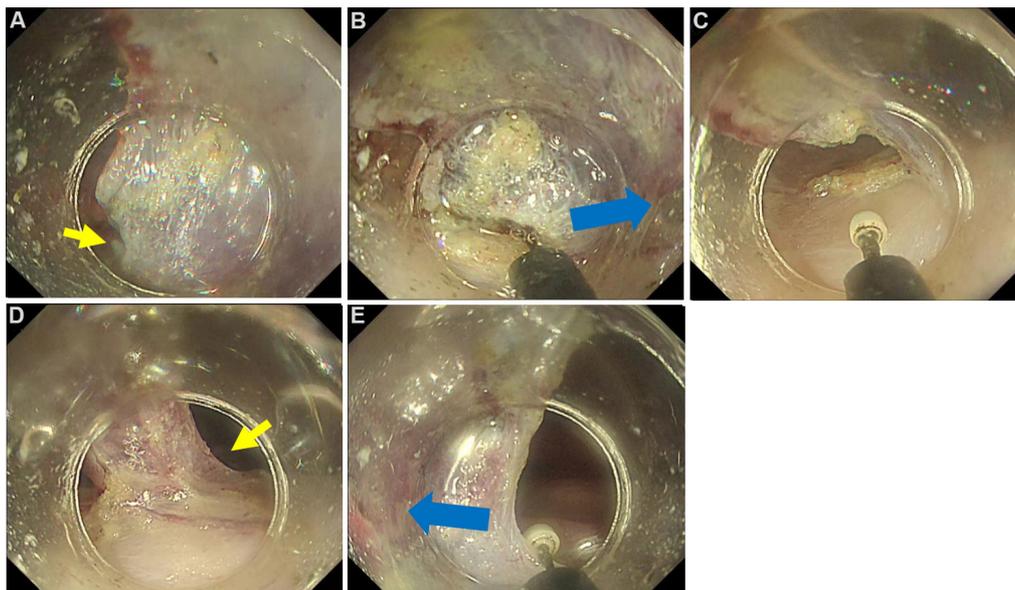


Figure 2. Submucosal dissection using IT knife nano[®]. (A) The edge of submucosal tissue is recognized using the ST hood short type[®]. (B, C) The blade of the IT knife nano approaches to the submucosal tissue. Then moving along the muscle layer (blue arrows), submucosal dissection is performed safely. (A, D, E) The procedure is performed turn by turn in both sides (yellow arrows).

from both sides. It is better to check the direction of resection every two to three times of energizing. In addition, even in cases with relatively large vessels, a longer coagulation wave can be applied to resection without bleeding [Figure 4]. Moving or pushing up the lesions half resected using a sheath of IT knife nano is sometimes effective when the operation field is difficult to recognize. In addition, the ST hood short type[®] (Fujifilm Co, Tokyo, Japan) is also useful for maintaining the surgical field and a better direct view by pushing up the lesions and their submucosa^[5]. Therefore, combining these techniques is one of the keys to safe and effective colorectal ESD using the IT knife nano.

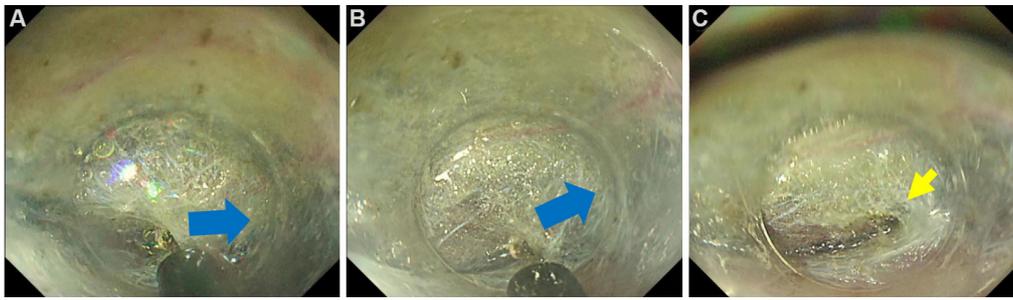


Figure 3. Submucosal dissection using IT knife nano®. (A, B) The blade is hooked in the edge of the submucosal tissue and moving to the center of submucosal layer (blue arrows) injected by blue-colored solution. (C) Submucosal tissue is resected safely (yellow arrow).

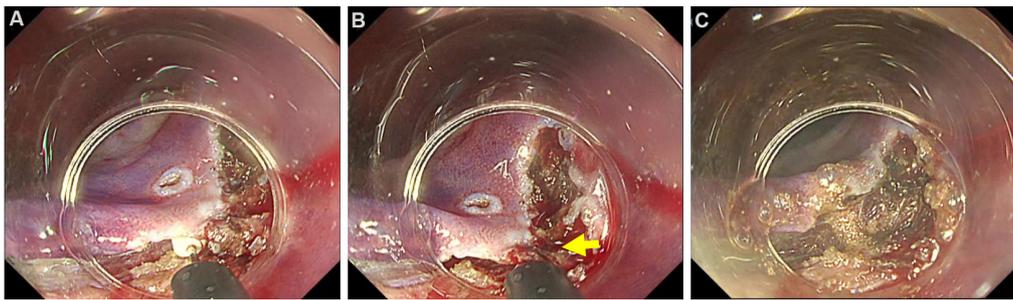


Figure 4. IT knife nano® can resect vessels without coagulation forceps. (A, B) A relatively large vessel is stuck (yellow arrow). (C) Long coagulation wave can burn and resect the tissue and vessel without bleeding.

In some cases, it may be difficult to manipulate the endoscope for anatomical reasons, such as flexure or movement of the lumen by breathing. Alternatively, the operation field of view may be difficult to maintain, and resection should be performed partially blind in such patients. These situations are dangerous. In such cases, moving the knife gradually from the center (inside) to the outside helps perform safe ESD. Yamashina *et al.*^[7] developed a pocket creation method (PCM) and reported its effectiveness in ESD of not only the colon but also the esophagus and stomach. This method is also effective with an IT knife nano. When performing the PCM technique with the IT knife nano, the insulated tip is first pressed against the submucosal tissue in the forwarding view. After maintaining the distance from the muscle layer, the submucosal tissue can be vaporized by a coagulation (forced or spray) wave, creating an indentation for the knife to be hooked. The submucosal layer can be resected by hooking the knife blade to the edge of the indentation and moving the endoscope to the left or right [Figure 5]. Adjusting the amount of air inflated also plays an important role. This procedure may make the resection speed slightly lower because the total length of the blade is not used. Therefore, by combining the PCM method with the tunneling method, the resection efficiency of the IT knife nano can be greatly improved [Figure 6].

Another unique use of the IT knife nano is touching the insulated tip to the submucosal tissue to stabilize the endoscope. Then, the submucosal layer can be resected by slowly moving or tilting the blade of the IT knife nano. It is often useful when the endoscope is unstable.

Table 1 lists the devices and settings used in the facility. The generator used was a VIO 300D® or VIO3® (Erbe Elektromedizin, Tuebingen, Germany). We used three coagulation modes, depending on the situation in VIO3.

Table 1. Setting of generators for IT knife nano®

VIO 300D®	Cut mode		Coagulation mode	
Effect	3	2		
Maximum watt	100 W	50 W		
VIO3®	Cut	Coagulation	Coagulation	Coagulation
Mode	Dry CUT	Precise SECT	Forced COAG	Swift COAG
Effect	4.7	6.0	6.0	5.0

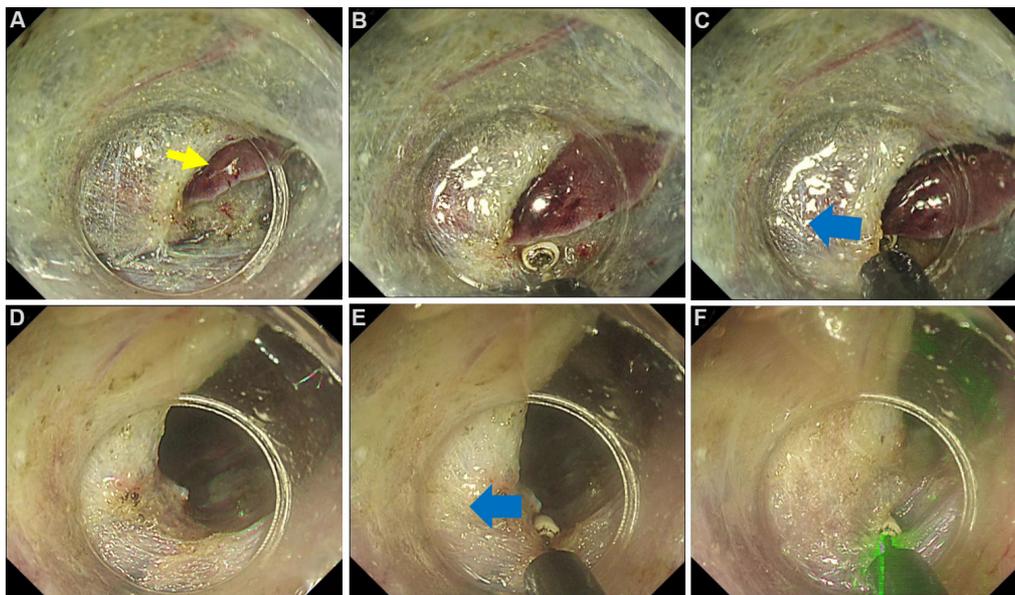


Figure 5. Pocket creation method technique using IT knife nano. (A) An injected submucosal layer is recognized by attaching hood devices. The insulated tip is put at the center of the submucosal layer (yellow arrow). (B, C) A little electric current makes a small indentation. (D-F) After hooking the blade to the edge of the indentation, the IT knife nano can move to the right side slowly (blue arrows) and resect the submucosal layer safely.

DISCUSSION

Various types of knife devices have been developed for colorectal endoscopic submucosal dissection. Therefore, it is often difficult to choose the optimal type of device. These two points can be considered when selecting a device: choosing the appropriate devices for the situation of colorectal ESD, and using a familiar knife as the main device because colorectal ESD requires training.

When the IT knife nano is used for colorectal ESD, it is mainly used for submucosal dissection. Additional needle-type devices are always required for first incisions. Therefore, performing ESD with a needle-type device should only be considered when cost-effectiveness is emphasized. However, the IT knife nano is considered as an option for difficult situations, such as lesions with severe fibrosis, or when rapid submucosal dissection is required.

CONCLUSION

When choosing a knife with an emphasis on cost-effectiveness, a needle-type knife device seems to be the most appropriate choice. However, the IT knife nano is stable even in situations where luminal movement by breathing or heartbeats make it difficult to use needle-type devices. In addition, it is expected to be able to complete the procedure without hemostatic forceps in colorectal ESD using the IT knife nano because it

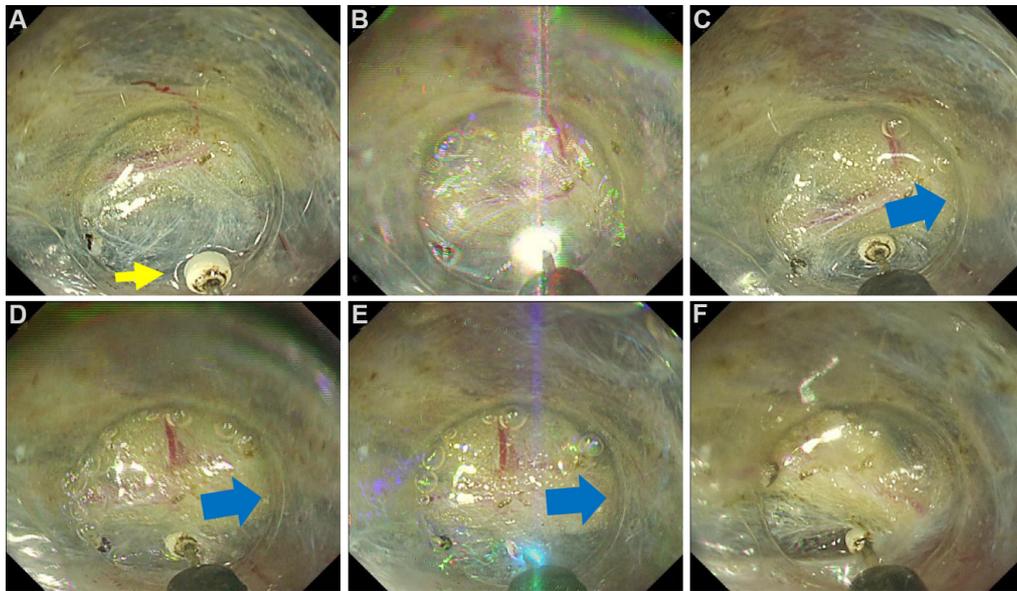


Figure 6. Pocket creation method (PCM) with tunneling technique with IT knife nano®. (A) A tunnel is made after continuing submucosal dissection by PCM (yellow arrow). (B, C) The blade of the IT knife nano is put on the edge of the tunnel and moved a little to the outside (blue arrow). (D-F) The procedure is performed repeatedly (direction to the blue arrow), and submucosal tissue is resected safely even if fibrosis exists.

has superior hemostatic performance compared to the needle-type devices.

The IT knife nano is different from the other needle-type devices in that it does not have a jet function. In the future, it is expected to have more functions as technology progresses and develops. We believe that the IT knife nano is an indispensable device for colorectal ESD in terms of safety, reliability, and efficacy.

DECLARATIONS

Authors' contributions

Data acquisition and writing manuscript: Takamaru H

Made substantial contributions to conception, data acquisition, and supervised: Saito Y

Availability of data and materials

Not applicable.

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Conflicts of interest

Saito Y received speaker's fees from Olympus Medical Co., Tokyo, Japan. Takamaru H declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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