For Healthcare Professionals

Basic operation and techniques for Endoscopic Hand Suturing

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Preliminary information and basic manipulation

Combined endoscopes and appropriate suturing directions

In endoscopic hand-suturing (EHS) , the suturing direction which best facilitates the procedure will vary depending on the position of the channel outlet at the distal end of the endoscope. When the channel outlet is positioned in the 5 o'clock direction in the endoscopic field of view, insert the needle from right to left (Photo 1). When the channel outlet is positioned in the 7–8 o'clock direction, insert the needle from left to right (Photo 2). In this section, we will focus on techniques using a scope with the channel outlet in the 5 o'clock direction. However, the basic concept remains the same when the channel outlet is in the 7–8 o'clock direction; only the suturing direction is different. For details on suturing from left to right, please review "Image of Continuous Suturing" on Pages 10–11. We also recommend watching the procedure videos, which can be accessed by scanning the QR codes on the following pages.

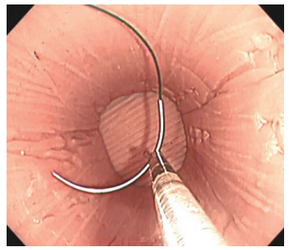


Photo 1: With GIF-2TQ260M

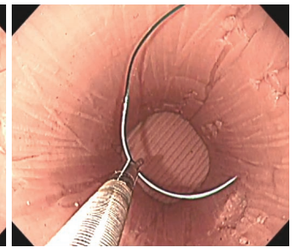
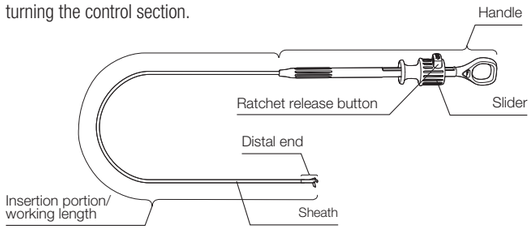
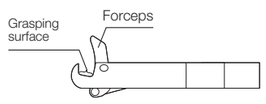


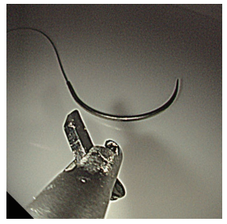
Photo 2: With GIF-H290T

External view of the Single Use Needle Holder FG-260

In most cases, the needle-holder is manipulated by an assistant. When the slider on the control section of the needle-holder is pulled towards the thumb ring, the movable jaw at the tip closes over the needle/suture bracket . A ratchet mechanism incorporated in the control section allows grasping strength to be gradually increased as the slider is pulled closer to the thumb ring with the target object held in the jaw. To open the tip of the needle-holder, press the ratchet release button and push the slider forward to raise the jaw . This device has high torque capability, which means you can turn the tip to the desired angle by turning the control section.







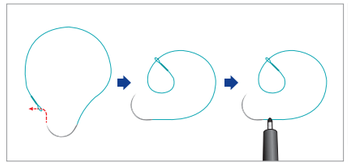
Preparation

Preparation of the suture thread

The suture thread used here is provided with a welded loop at the end . After a single stitch is made, the needle is passed through this loop to make a knot and the suture is left on the tissue. It is often difficult, however, to pass the needle through this small loop in the digestive tract. It is recommended to pass the needle through the small loop and make a larger loop outside the patient's body in advance. This will make it easier to make a knot and leave the suture in the digestive tract.

Insert the needle-holder into the scope's channel before starting the procedure

When the movable jaw at the tip is closed, the needle-holder can be passed through channels 3.2 mm or more in diameter. Since the needle cannot be inserted into the channel, insert the needle-holder into the scope's channel before inserting the scope into the patient. Push the needle-holder until the tip is projecting slightly from the scope tip. Open the jaw and grasp the suture. (In the overtube method described below, grasp the suture at a point 5–10 mm from the swaged end of the needle . Similarly, in the hood method , also discussed below, grasp the suture at a point about 5 mm from the swaged end.)



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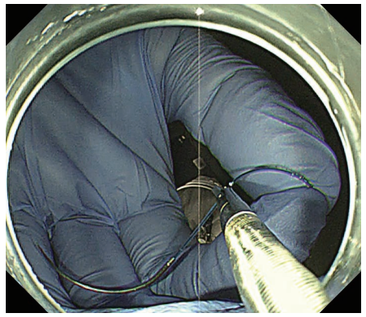
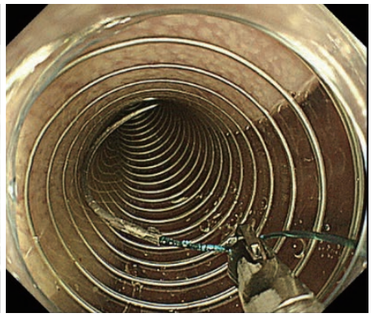
Insertion into the gastrointestinal tract

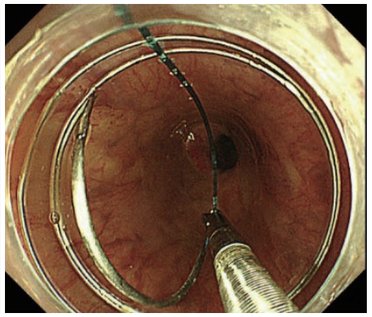
Insert the needle and suture into the GI tract using the following method.

Overtube method

With this method, an overtube is used to insert the needle and suture into the GI tract. (Use the Covidien 26 mm VLOCL0604 in the stomach. If space is limited, e.g., in the colon, use the Covidien 17 mm VLOC0804.)
Before inserting the scope into the patient, project the needle-holder slightly from the scope tip and hold the suture at a point 5–10 mm from the swaged end of the needle. Do not hold the needle directly. Doing so increases the risk of injuring other structures when the scope is inserted into the GI tract. Conversely, if the suture is held at a point too far from the needle, the needle may get caught between the scope and the GI wall, which could make it impossible to confirm the tip of the needle, thereby posing a risk of erroneous puncture or damage to the endoscope. Holding the suture near the needle makes it impossible to apply force towards the needle point , preventing the needle from making an unwanted puncture.
Project the needle-holder from the scope tip so that the entire needle is visible in the field of view and keep it in that position. Perform insufflation as required to ensure sufficient luminal space. Advance the scope slowly, bending the scope tip as necessary to keep the tip of the needle-holder in the center of the lumen.





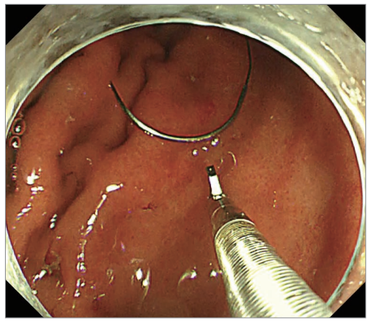


Grasping the needle

How to position the needle

Place the needle on a flat surface in the direction of gravity

After confirming that the entire needle and suture (including the end of the suture) has completely entered the target site, grasp the needle.
Move the needle to an appropriate position in the lumen using the needle-holder so that the tip of the needle is pointing in the direction in which suturing will be performed. If the channel outlet on the distal end of the scope is positioned in the 5 o'clock direction, move the needle to a flat place in the direction of gravity inside the lumen so that the tip of the needle points to the left. If any water or blood is still in the lumen, the needle may be submerged, making it difficult to see. To prevent this, perform sufficient suction beforehand (Photo 1).

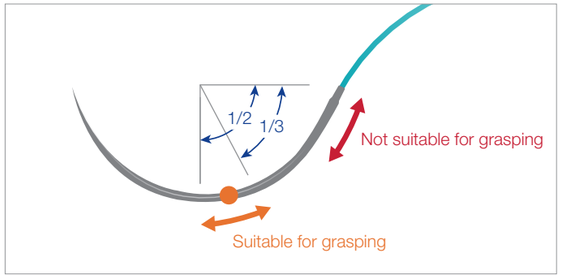


(Photo 1)

Grasping the needle and approaching the target

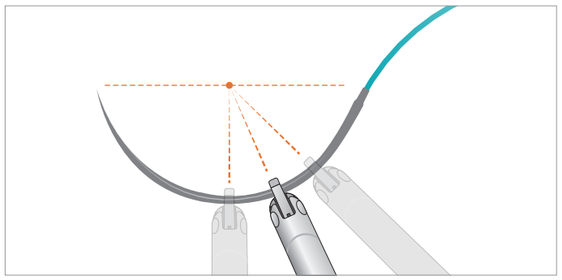
Grasp the needle at a point roughly 1/3–1/2 of its length from the swaged end

To ensure you can maneuver the needle properly, it must be grasped at the right point. If it's grasped too close to the needle point, the needle won't be able to puncture the tissue, making it difficult to maintain a firm grasp. If it's grasped too close to the swaged end, clamping strength will be reduced because the end of the needle is rounder and harder to lock onto securely. For best results, grasp the needle at a point 1/3–1/2 of the needle length away from the end.



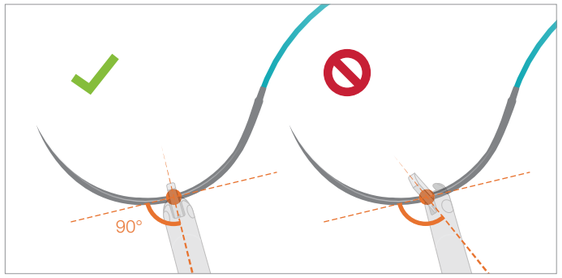
Approach the needle pointing the needle-holder's tip so that it's perpendicular to the center of the needle arc

While maneuvering the scope so that the tip of the needle-holder points to the center of the needle arc, bring the needle-holder close to the needle.



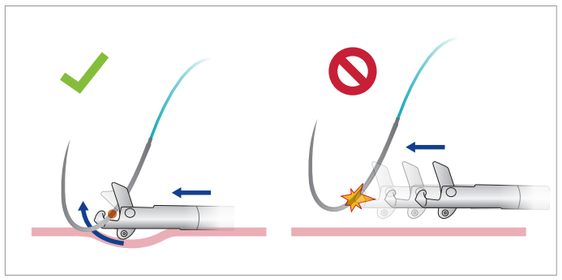
Rotate the needle-holder so that the raised jaw is perpendicular to the needle

Turn the control section of the needle-holder until the open jaw is perpendicular to the needle. If the jaw is oblique to the needle, the needle may slide away and the jaw will close without grasping the needle . Grasping is sometimes possible even in this condition; however, the tip of the needle won't rotate correctly when the needle-holder is twisted, making it difficult to puncture the tissue. Similarly, when the needle is placed on the distal hook of the needle/suture bracket and the jaw is closed, the needle may slip off if force is applied to the needle.



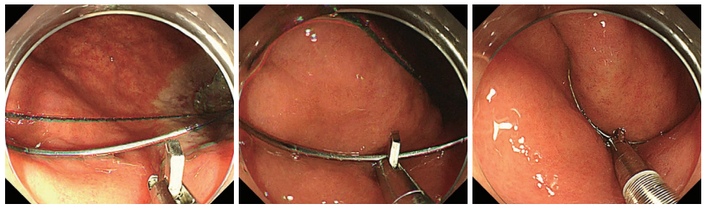
Hook the needle with the tip of the needle-holder to grasp it

Place the needle between the movable jaw and the needle/suture bracket and pull the slider towards the thumb ring to grasp the needle. While doing so, focus on the hook on the distal side of the needle/suture bracket and manipulate the needle-holder as if picking up the needle from below. When the jaw closes and the needle is secured, pull the slider halfway while pressing the needle slider's tip gently against the wall so that the arc of the needle is perpendicular to the needle-holder. When the needle is grasped at an appropriate angle, pull the slider all the way.



Grasp the needle in close view

When you try to grasp the needle in distant view, you will find it difficult to get a sense of distance in the depth direction regarding the positioning of the needle-holder tip. This increases the likelihood that the tip will close without grasping the needle . Try to grasp the needle while observing the needle-holder tip in close view.



(Photo 1) (Photo 2) (Photo 3)

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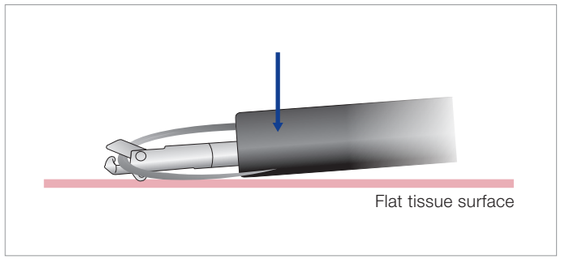
Correcting the needle direction

When the arc of the needle is not perpendicular to the needle-holder

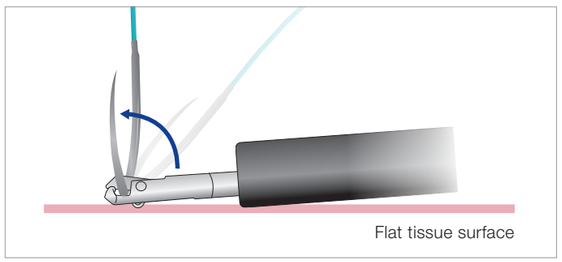
Loosen grasping

When the arc of the needle is not perpendicular to the needle-holder (the needle is lying down), press the ratchet release button while the length of the tip is gently pressed down against the wall to loosen the grasping. And keep the needle grasped loosely.



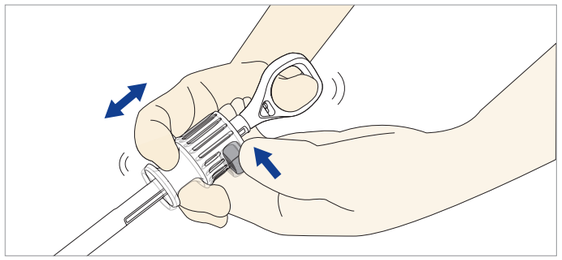
Press the needle against the wall to raise it

Gently grasp the needle and bend the scope tip downward to gently press the needle against the mucosa. The mucosa will push back on the needle and raise at it to an appropriate angle. When the arc of the needle is perpendicular to the needle-holder, pull the slider all the way to tightly grasp the needle.



If the needle cannot be raised easily, move the slider back and forth in short strokes

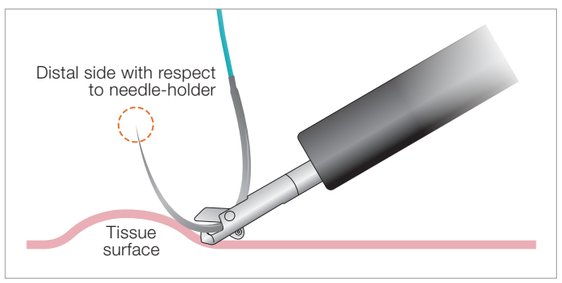
If you find it difficult to raise the tip and the end of the needle, you should move the slider back and forth in short strokes to apply vibrations to the tip of the needle-holder. By doing so, you may be able to raise the arc of the needle properly.



When the needle is grasped obliquely

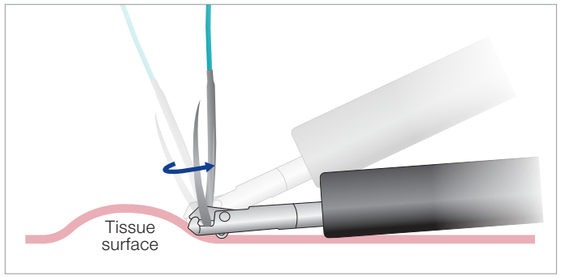
Loosen the grasp

As described above, gently release the ratchet while the tip of the needle-holder is gently pressed against the wall to make a loose grasping.



Press the distal side of the needle with respect to the needle-holder against the wall

Slowly press either end (point or swage) of the needle on its distal side with respect to the needle-holder against a fold on the GI tract, for example, to correct the angle of the needle. When the line that connects the needle point and swage is perpendicular to the needle-holder, pull the slider all the way to tightly grasp the needle.

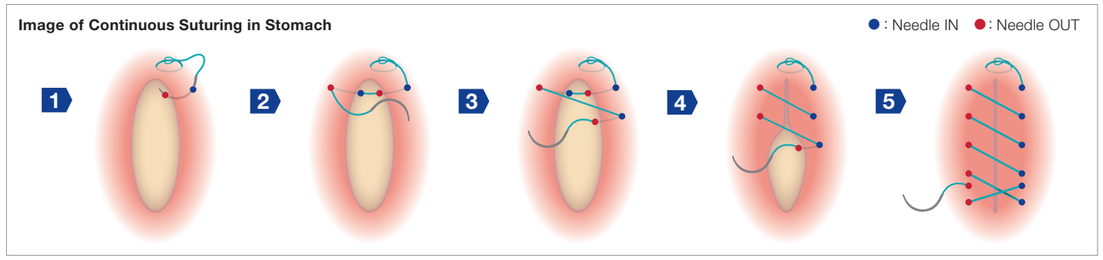


Continuous suturing

Suturing in the stomach

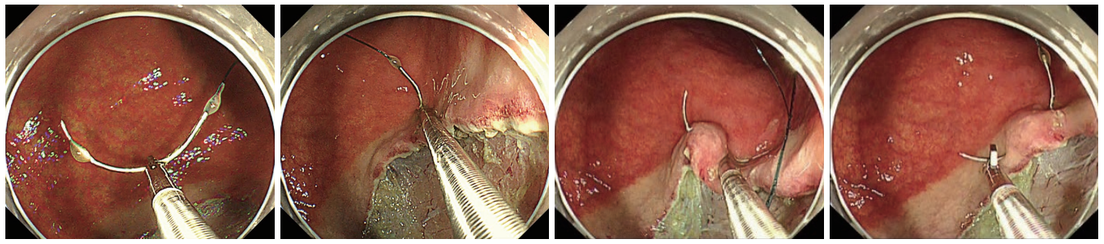
Keep the suturing target properly positioned in the field of view

In general, you should perform a continuous suture from the distal side to the proximal side of the endoscopic field of view. In other words, start suturing from the anal side when using a forward maneuver and from the oral side when using a retroflex maneuver. The easiest position for suturing is with the target tissue in the 6 o'clock direction. Maneuver the scope so that the puncture point is as low as possible in the field of view. When the needle is being maneuvered, the scope needs to follow the direction in which the needle is being advanced. The trick here is to position the scope tip so that there is plenty of room to move it around as much as the needle is going to be maneuvered. It is also a good idea to bend the scope tip in all directions to get an idea of how maneuverable it is.



Maintain sufficient distance between the scope and needle

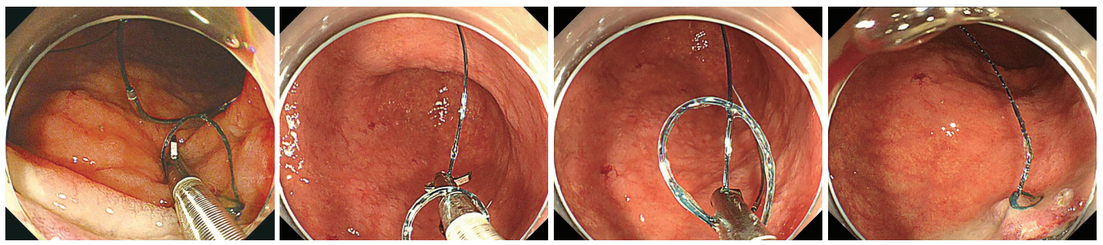
If the needle is too close to the scope when it is being maneuvered, you may lose sight of the needle point , making it impossible to safely puncture the tissue. If the needle is too far from the scope, accurate puncturing will be difficult because the needle-holder shaft will be warped, making it difficult to transmit force to the needle point. Be sure to keep the right distance between the needle and scope. (Photos 1–4)



(Photo 1) (Photo 2) (Photo 3) (Photo 4)

Secure the loop at the end of the suture after the initial puncture

After the initial puncture, pull the suture to bring the loop at the end of the suture close enough to the puncture and place the needle on the distal side of the loop (Photo 1). Pass the needle-holder through the loop, grasp the suture near the needle (Photo 2), and pull the needle-holder so that the entire needle passes through the loop (Photo 3). Confirm that the needle has passed all the way through the loop and then stitch the site securely by pulling the suture until the loop is almost closed to fix the suture (Photo 4). As for the needle and suture, use the Covidien V-Lock™. Use the 26 mm VLOCL0604 in the stomach. When space is limited as in the colon, use the 17 mm VLOC0804.



(Photo 1) (Photo 2) (Photo 3) (Photo 4)

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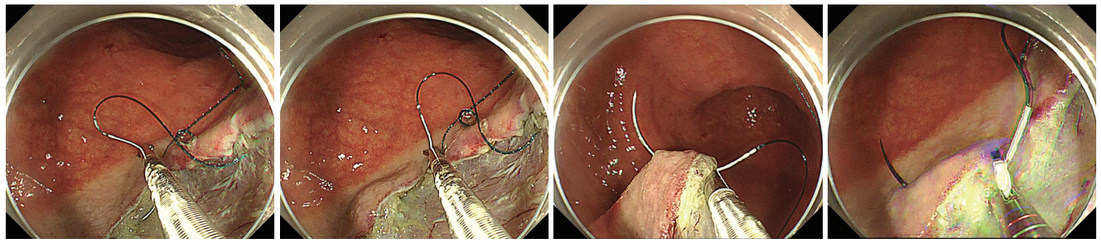
Coordinating the scope and needle-holder

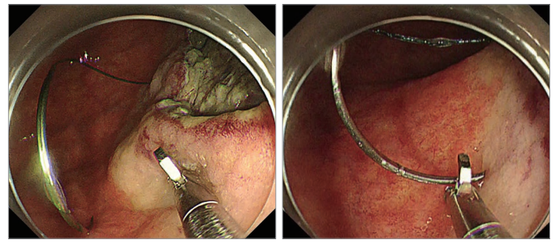
Move the needle in and out of the tissue by coordinating the scope and needle-holder. Have the assistant point the tip of the needle in the appropriate direction, then push, pull, and bend the scope to approach it to the target and puncture the tissue (Photo 1). The assistant should now twist the needle-holder until the orientation of the needle point is parallel to the muscularis. Advance the needle through the tissue by bending the scope tip to left and right (Photo 2). When the puncture is deep enough, bend the scope tip and twist the scope shaft as required, while the assistant twists the needle-holder as necessary to push the needle point out of the tissue (Photo 3). Once the needle has penetrated the tissue sufficiently, have the assistant slowly open the jaw to release the suture (Photo 4). While doing this, the assistant should twist the needle-holder to bring the jaw closer to the swaged end of the needle to make it easier to release the suture from the needle-holder. Then grasp the point of the needle again to pass the needle through the tissue.



(Photo 1) (Photo 2) (Photo 3) (Photo 4)

Do not release the needle if possible

One of the most difficult aspects of this technique is to grasp the needle at the right point and angle when the needle is released (Photo 1). Avoid releasing the needle during manipulation and try to keep the needle in the tissue at all times (Photo 2). That way, the needle can be secured, and you can grasp it at the right point.



(Photo 1) (Photo 2)

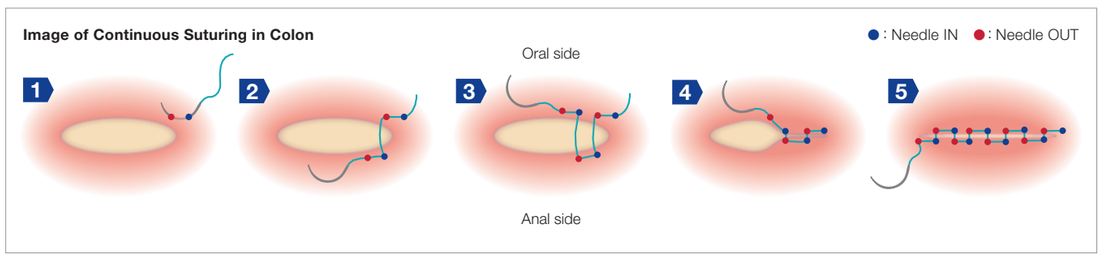
Suturing in the colon

Basic maneuvering is the same

When you perform EHS in the colon, basic maneuvering of the needle is the same as in the stomach. Grasp the needle at an appropriate point and move the needle in and out of the tissue by coordinating the scope and needle-holder. As the colon has a smaller lumen and thinner mucosa than the stomach, use a small 17 mm needle.

Suture the site along the long axis of the lumen to make the suture line in the short axis direction

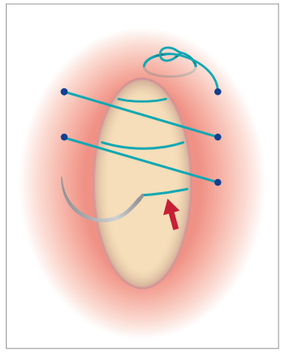
Because space is limited in the colon, intestinal stenosis may occur if the suture line is made in the long axis direction of the lumen as in the stomach. Thus, suture the site while closing the mucosal defect as if bringing the tissue proximally and distally with respect to the lumen. In other words, pass the suture thread through the tissue alternately on the oral and anal sides and suture the site as if the stitches cross the defect longitudinally along the lumen.



Closure

Grasp and pull the suture on the needle after it has penetrated the tissue

Unless you keep pulling the suture in continuous suturing, you won't have enough suture left, making further procedure difficult. Close the mucosal defect while pulling the suture as necessary (Figure 1). Before pulling the suture, stick the needle in the next puncture point to minimize the possibility that the needle will be released.



(Figure 1)

In continuous suturing, pull the suture in the direction in which the needle advances to tie the tissue (Photos 1–6). Grasp the suture near where the needle has exited the tissue and pull on it. The suture will be quite long at first, so pull it and regrasp it a few times. At the end, pull the suture firmly in the opposite direction of the needle exit side to tie the tissue securely. If the suture is pulled from the needle entry side, it may not only prevent you from getting enough traction, but also result in the application of excessive force in the opposite direction of the barbs on the suture, which could damage the tissue. (Figure 2).

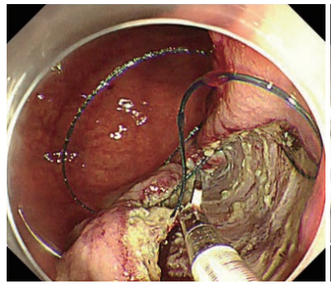


Photo 1: Choose suture to pull

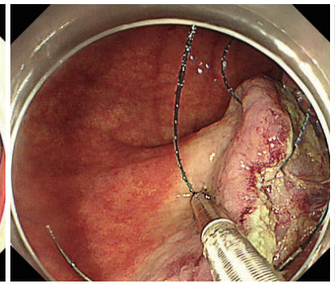


Photo 2: Grasp suture on needle exit side

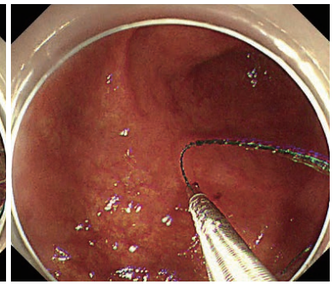


Photo 3: Pull suture in stitching direction

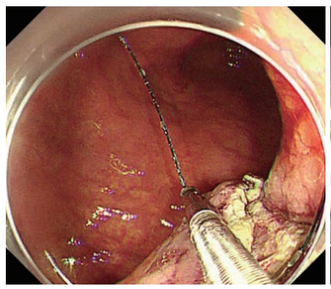


Photo 4: Regrasp suture which has been pulled

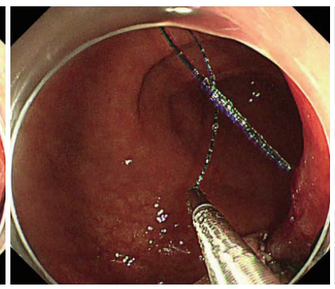


Photo 5: Pull suture in stitching direction again

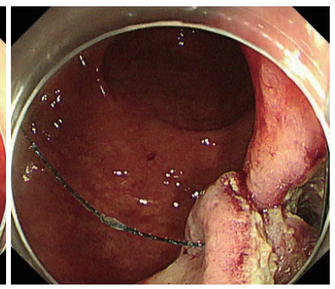
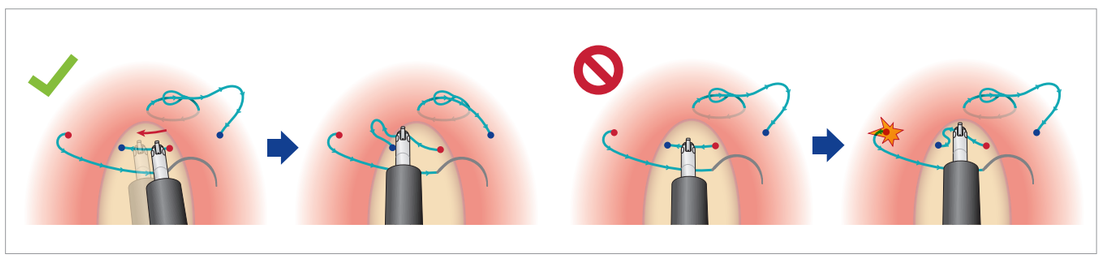


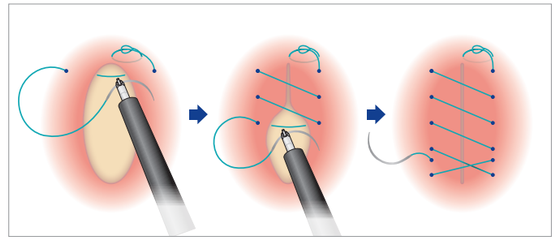
Photo 6: Mucosa has now been securely secured



(Figure 2)

For detailed information, visit the website below or scan the QR code on the right.
https://www.olympusprofed.com/gi/endoscopic-suturing/

Moreover, if excessive force is applied to the section that connects the suture at the swaged end, the suture may detach from the needle. Whether you're just pulling the suture or tying the tissue, try not to pull the suture by grasping and pulling on the needle. Pull on the suture itself. After closing the mucosal tissue using continuous suturing, make a final stitch in the direction opposite to the stitching direction to complete the procedure (Figure 3).



(Figure 3)

Do not retract the needle-holder into the channel while grasping the suture

If you pull the suture while retracting the needle-holder into the channel, the needle may get stuck inside the distal attachment or the channel. Try to avoid retracting the needle-holder while grasping the suture. If you have no choice, make sure that the needle is far enough away from the scope tip.

Do not grasp the suture too tightly

The suture should be grasped tightly enough not to slip when tying the tissue. When grasping the suture with the needle-holder, however, open the jaw fully first and close it until the ratchet clicks a few times. Try not to pull the slider too much.

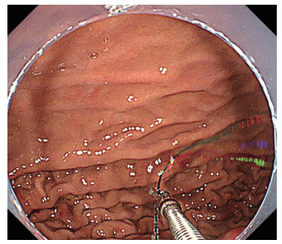
Cutting the suture

Cut the suture at a point 5–10 mm from the needle exit point

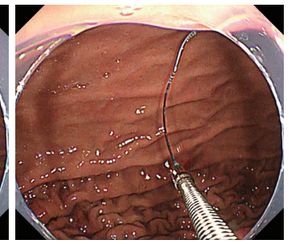
Having completed suturing, cut the suture using the dedicated single-use loop cutter (FS-410). Place the tip of the loop cutter at a point on the suture 5–10 mm from the needle's exit point. Cut the suture while applying tension to it. To do this, open the jaw of the loop cutter to catch the suture gently, pull on the suture slightly, and then close the jaw all the way to cut it.

Place the bracket of the loop cutter perpendicular to the suture

If you pull the slider on the control section of the loop cutter when the suture is roughly parallel to the blades on the tip of the loop cutter (i.e., not in a perpendicular condition), the suture may catch without getting cut. Place the bracket on the tip of the loop cutter perpendicular to the suture. Then while applying light tension to the suture so that there is no slack between the blades, cut it quickly (Photos 1–2). Do not use scissors forceps with reduced shearing capability. This will increase the risk of catching the suture. Always use the dedicated single-use loop cutter.



(Photo 1)

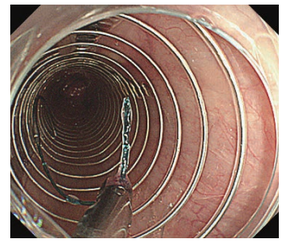


(Photo 2)

Retrieving the needle

Grasp the suture and pull the scope and needle-holder together

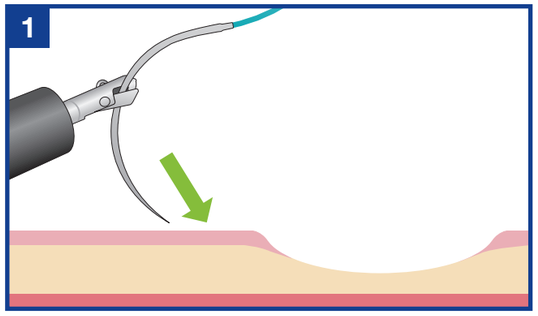
When retrieving the needle, do not grasp the needle; instead, grasp the suture in the same way during insertion (Photo 1). While holding the suture near the swaged end (5–10 mm from the end of the needle) so that the needle is able to move passively, slowly pull the needle together with the scope. While doing this, keep checking the position of the needle point. Perform insufflation as required to ensure visibility of the entire needle.



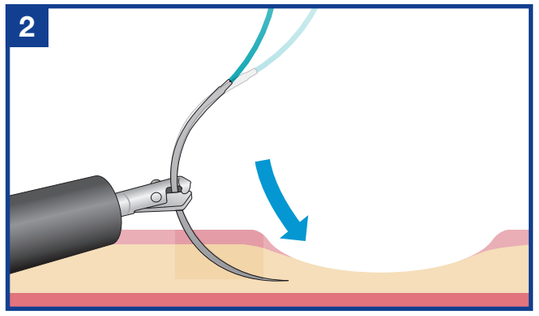
(Photo 1)

For detailed information, visit the website below or scan the QR code on the right.
https://www.olympusprofed.com/gi/endoscopic-suturing/

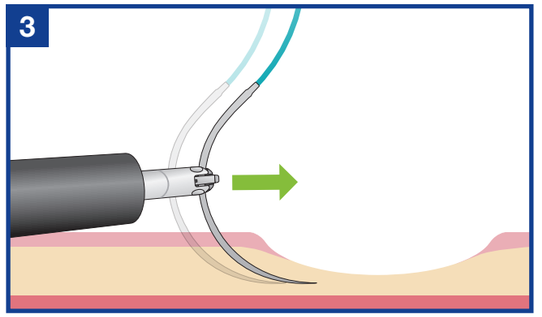
Image of continuous suturing (When the GIF-H290T is used)



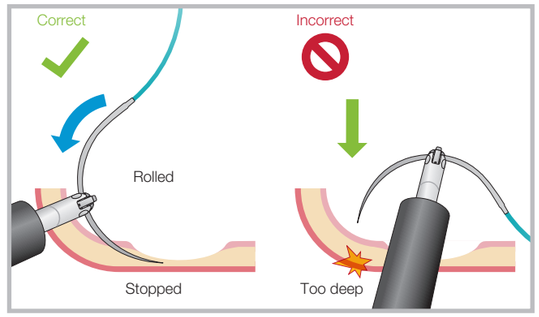
The endoscopist pierces the needle obliquely and stops at the desired depth. This trick helps you control the depth of suturing. Be careful not to pierce the needle too deeply.



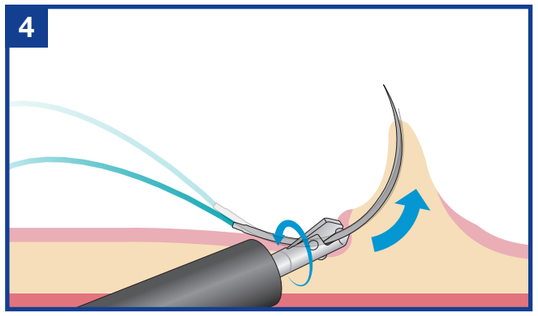
The assistant twists the needle-holder until the needle point is pointing parallel to the tissue surface. This helps control suture depth.



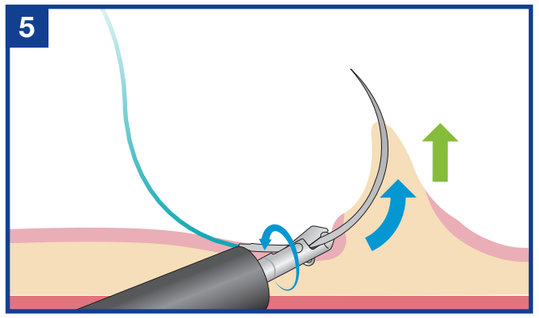
The endoscopist advances the needle in parallel to the tissue surface. This ensures a suture "bite" (the distance from the point of insertion of the needle to the edge of the mucosal defect).



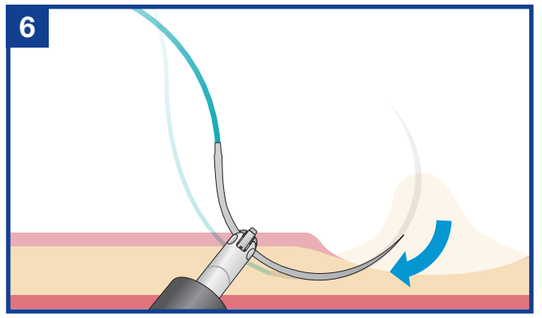
If there is no choice other than piercing downward, controlling the penetration depth is especially important. As soon as the endoscopist has punctured the surface of the tissue using endoscopic maneuvers, the assistant immediately twists the needle-holder to point the tip of the needle parallel to the tissue.



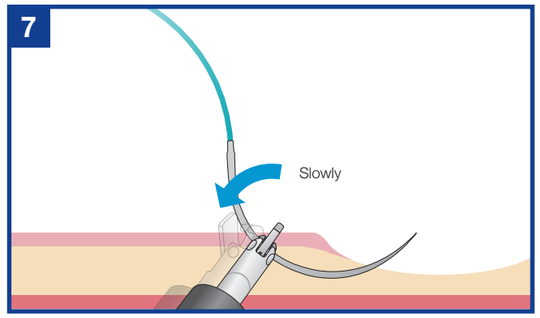
The assistant twists the needle-holder to apply force in the direction of the needle point to bring the needle point out of the tissue.



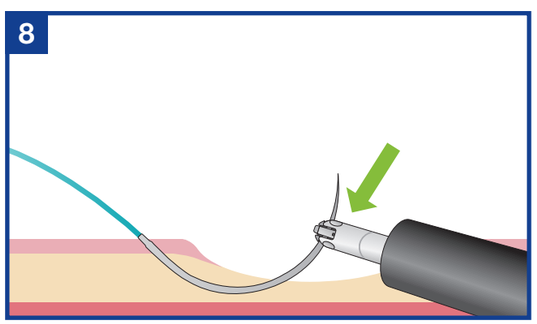
After twisting the needle-holder to project the needle point as necessary, the assistant then twists the needle-holder back towards the original position until no tension is applied to the tissue.



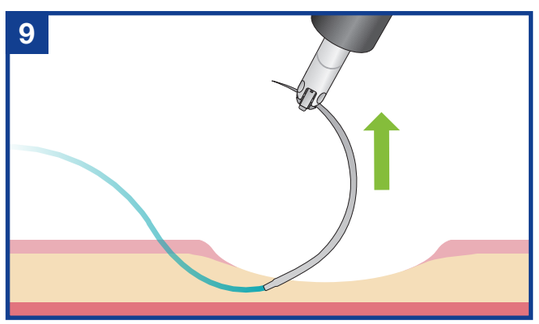
Once the needle is sufficiently penetrated through the mucosa, return the needle-holder to its original rotation until no tension is applied to the tissue. This helps prevent the needle point from getting stuck in the tissue due to the reaction caused by the application of tension to the mucosa when the needle is released.



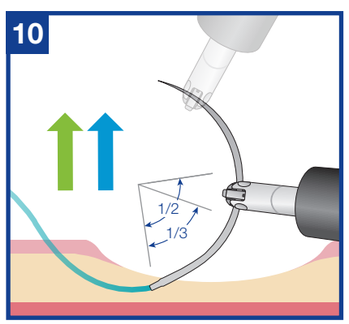
The assistant slowly opens the jaw on the tip of the needle-holder and, while the jaw is kept fully open, twists the needle-holder counterclockwise to release the needle. This allows the needle to be released from the needle-holder smoothly.



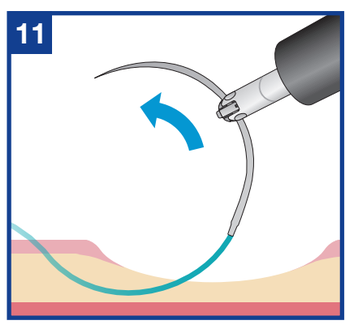
The endoscopist manipulates the scope to help the assistant grasp the tip of the needle protruding from the mucosa.

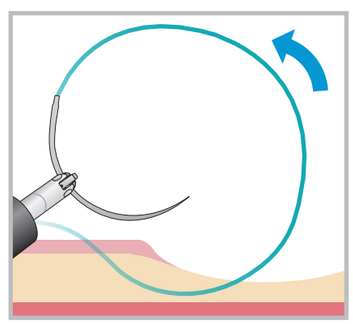


The endoscopist pulls the needle upward using endoscopic maneuvers, stopping while part of the needle is still in the tissue. (This is easier to do using only endoscopic maneuvers without twisting the needle-holder.) This facilitates regrasping of the needle.



Release the needle once and regrasp the needle at a point 1/3–1/2 from the swaged end.





Pull out the needle completely. Then twist the needle-holder counterclockwise to move on to the next puncture. This keeps the suture from getting tangled.

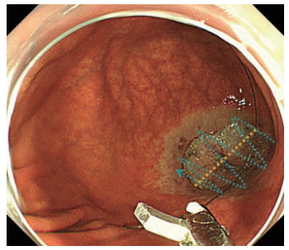
Technical Strategies (Upper/Lower GI)

Nippon Medical School Hospital Osamu Goto, MD, PhD

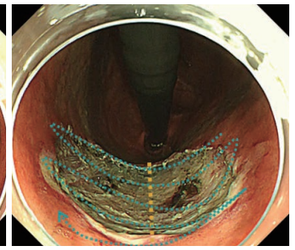
Upper GI

Suturing direction and scope's position

Since the stomach has a wide lumen and there is a lower risk of stenosis caused by suturing except in the cardia and pylorus, suture the site so that the suture line is in the long-axis direction. In most cases, start suturing from a point distant from the scope, moving closer as you suture (Photo 1). Maneuver the scope so that the defect is positioned in the lower part of the view field, while viewing the site obliquely and not from right above. When the site is in the upper stomach or somewhere in the anterior wall or lesser curvature, retroflex the scope to adjust the scope position (Photo 2).



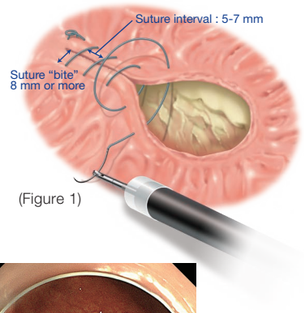
(Photo 1)



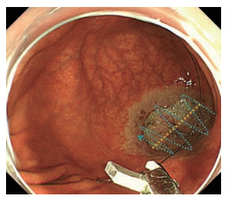
(Photo 2)
* Yellow broken line: Proposed suture line
Green broken line: Direction of suturing

Suturing in practice

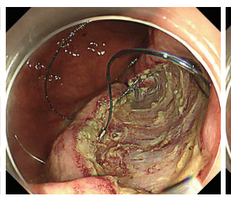
To ensure a suture "bite" (the distance from the point of insertion of the needle to the edge of the mucosal defect) of 8 mm or more, insert the needle at a point outside the mucosal rim of the defect and slide the needle through the tissue immediately above the muscle layer, pushing it out of the tissue immediately above the muscle layer on the edge of the defect. Then insert the needle at a lateral point on the opposite mucosal rim and move it to a point 8 mm or more from the mucosal rim. After securing the suture thread, perform continuous suturing at 5–7 mm intervals (Figure 1). When you reach the end, grasp the suture and pull it to draw together the tissues. You can pull the suture at every stitch. However, if the sutured area is tied too tightly, the edge of the defect may be pulled inward, which could make it difficult to guide and insert the needle at an appropriate depth in the next suture. So only tighten the stitches up to the one before last. (Photos 1–8)



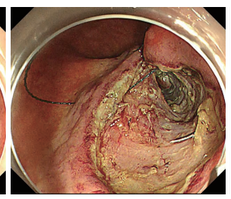
(Figure 1)



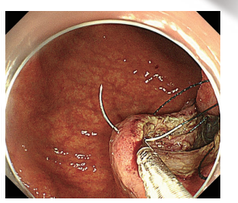
(Photo 1)



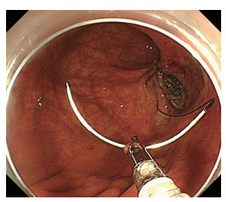
(Photo 2)



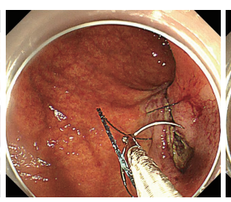
(Photo 3)



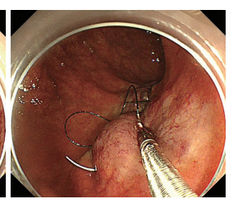
(Photo 4)



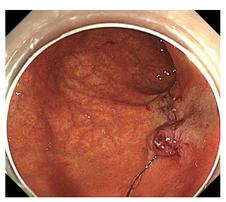
(Photo 5)



(Photo 6)



(Photo 7)

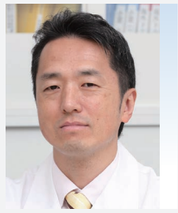


(Photo 8)

Notes on anatomy

It is easier to place the suturing site in the lower part of the view field in the gastric body, especially in the greater curvature and posterior wall, because the scope can be kept straight in those regions. Consequently, this procedure can be performed most easily there. In the antrum and lesser curvature, on the other hand, it may be necessary to retroflex the scope to suture the defect. Therefore, it is required that the suture start position and piercing direction be decided carefully in advance. As suturing proceeds, the lumen becomes narrower in the antrum, which may make it difficult to manipulate the needle. Use extra caution if this happens. In the angulus and fundus, the degree of difficulty is especially high in terms of positioning the scope at an appropriate angle. Also, it is usually a good idea to avoid suturing in the cardia and pylorus whenever circumstances allow since the technique itself is difficult in those regions and there is a risk of stenosis.

For detailed information, visit the website below or scan the QR code on the right.
https://www.olympusprofed.com/gi/endoscopic-suturing/



Endoscopy Division, National Cancer Center Hospital Yutaka Saito, MD, PhD

Dr. Saito graduated from Gunma University School of Medicine in 1992 and completed the postgraduate course in medicine at the same school in 1996. For the next five years he continued his studies as a resident and chief resident in the Endoscopy Division at the National Cancer Center Hospital, then moved on to the Department of Gastroenterology at Mitsui Memorial Hospital in 2001 where he spent two years. In 2003, he returned to National Cancer Center Hospital's Endoscopy Division where he continued to pursue a career in clinical diagnosis and treatment, as well as research in gastrointestinal endoscopy. He has been the Director of the Endoscopy Division at the National Cancer Center Hospital since 2012. He also has served as an attending Professor of Gastroenterology at Tokyo Medical University since 2017.

Lower GI

Insertion precaution

When inserting the needle from the anus, you can avoid injury to the anus by using a single-use splinting tube (Olympus ST-CB1) or lower GI sliding tube.

Single-use splinting tube
ST-CB1

Suturing direction

Because space is limited in the colon, stenosis may occur if the suture line is made in the long axis direction of the lumen as is done in the stomach. Thus, suture the site while closing the mucosal defect as if bringing the tissue proximally and distally with respect to the lumen so that the suture line is in the short axis direction (Figure 2).

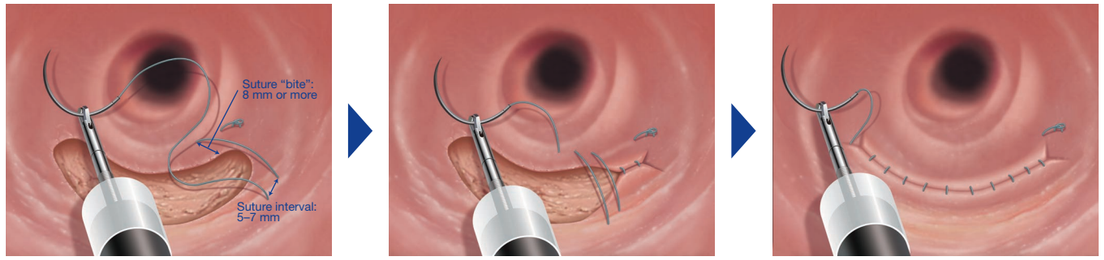


Figure 2 EHS in the colon

That is, pass the needle alternately through the oral and anal sides of the tissue, sewing the thread longitudinally across the suture.

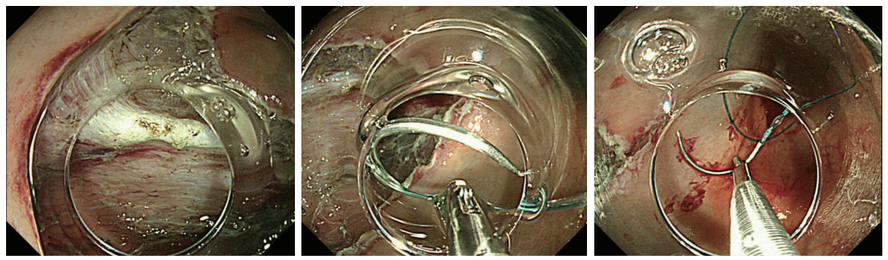
Suture interval, bite, and depth, degree of stitching, etc.

The muscle layer of the colon is thinner than that of the stomach. To prevent the needle from poking through the lumen, always inject saline into the normal mucosa around the ulcer base. To ensure a suture "bite" (the distance from the point of insertion of the needle to the edge of the mucosal defect) of 8 mm or more, insert the needle at a point in the mucosa at the edge of the ulcer base on the oral side and slide the needle right above the muscle layer, pushing the needle point out right above the muscle layer on the edge of the mucosa around the defect. Then insert the needle right above the muscle layer on the edge of the mucosa on the anal side of the ulcer base. Advance the needle as if sliding right above the muscle layer and push it out at a point 8 mm or more from the edge of the defect. Now pull the thread to eliminate any slack.

After securing the suture thread, perform continuous suturing at 5–7 mm intervals from the oral side to the anal side in the same manner described above (Figure 2). Every time you make a stitch, pull on the thread to draw the tissue together. However, if you tie the sutured area too tightly, the edge of the defect may be pulled inward, making it difficult to guide and insert the needle at an appropriate depth in the next suture. To avoid this, don't tighten the last stitch.

Additional tips

When performing a procedure at the proximal colon — e.g., in the cecum, it is a good idea to use a disposable sliding tube to perform ESD and EHS as this will make it easier to switch devices. At our hospital, we use a short ST hood (Fujifilm DH-28GR) when we do a colonic ESD. This way we can keep the hood attached to the scope tip even when we use a disposal sliding tube.
Another point to remember is that you need to start suturing from the anal side when the site is close to the anal verge. If suturing of the anal side is left until the end, suturing will be quite difficult. You can also retroflex the scope to perform this technique.



(A) (B) (C)

(D) (E) (F)

(G) (H)

Figures

(A) After cecal ESD
(B) A needle is inserted through the disposable sliding tube and delivered to the ulcer after ESD.
(C) The first stitch is made on the right end of the defect. Insert the needle at a distal point with respect to the endoscope.
(D) To make the third stitch, insert the needle at a point roughly median and distal with respect to the endoscope.
(E) The thread is pulled to securely tighten the stitch.
(F) Excess thread is cut with scissors forceps.
(G, H) The 5 cm ulcer in the base of the cecum is now completely sutured.

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