



For Healthcare Professionals

Potential of the VISERA ELITE III Surgical Endoscopy System in Colorectal Surgery



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Features of VISERA ELITE III

VISERA ELITE III was launched in December 2022 as a new surgical endoscope system. VISERA ELITE III is the successor to VISERA ELITE II and is equipped with the following four features. (1) an all-in-one system for various observations, (2) high-definition 4K images, (3) various IR fluorescence observations, and (4) high-quality 3D images. These features are expected to further improve the quality of endoscopic surgery.

We will present an overview of this system and its potential applications in the field of colorectal surgery, including our own experience using it.

VISERA ELITE III VIDEO SYSTEM CENTER OLYMPUS OTV-S700
OTV-S700 UPGRADE PACK IR MAJ-2512
VISERA ELITE III LED LIGHT SOURCE OLYMPUS CLL-S700
4K CAMERA HEAD OLYMPUS CH-S700-XZ-EA

1 All-in-One System

In VISERA ELITE III, 4K/3D/IR observation functions are integrated into one system. Therefore, all departments can use the system according to their applications, allowing for flexible organization of operating room schedules and effective use of equipment.

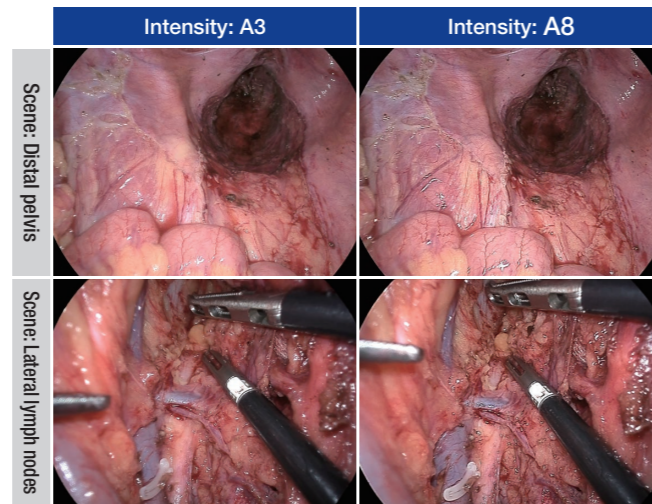
2 High-definition 4K Video

Video Customization

Color adjustment and image enhancement functions are provided for video customization. For color adjustment, in addition to the red and blue color tone settings that can be adjusted in VISERA ELITE II, it is now possible to adjust the hue and saturation of red, orange, yellow, and red-violet. The image enhancement functions include structure enhancement and contour enhancement. Structure Enhancement emphasizes only the frequency components in a certain bandwidth, allowing the user to emphasize fine patterns and contours in a specific bandwidth in an image. Edge Enhancement emphasizes the contours of the entire endoscopic image and can make structures more clearly visible. On the other hand, because it emphasizes the contours of the entire image, it tends to be noisier when enhanced compared to structure enhancement.

The coloration of organs and tissues in the abdominal cavity is affected by various factors, including the patient and the brightness of the scope. By using color adjustment, the surgeon can adjust the color to his or her preference.

Structure enhancement/contour enhancement produces a crisp image. The edges of the sparse connective tissue between the layers are enhanced, allowing the surgeon to clearly see the tissue to be dissected.



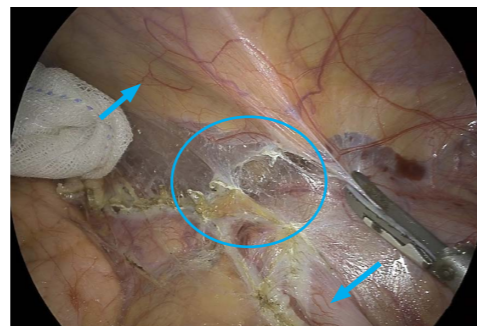
Structure-enhanced A

Focus Adjustment

The VISERA ELITE III camera head is equipped with EDOF (Extended Depth of Field) for greater depth of field and C-AF (Continuous Auto-Focus) for automatic focus acquisition.

Depth of field is a photographic term that refers to the area in front of and behind a subject that appears to be in focus when the subject is in focus (it is easy to understand if you imagine that there are photos with a clear background and photos with a blurred background). In surgical images, it is better to have a deep depth of field to minimize out-of-focus areas and to have the image appear as clear as possible; with EDOF, the range of focus from front to back is wider than with conventional 4K systems in surgeries such as deep pelvic and transanal surgeries, where the surgeon is moving through a narrow space. The C-AF system has enabled a wider range of focus from the front to the back than conventional 4K systems.

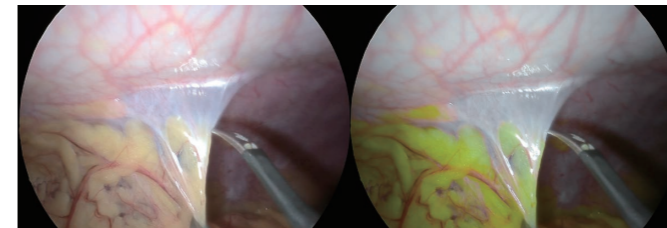
C-AF eliminates the need for detailed focus adjustment, which has been an issue with conventional rigid mirrors. While out-of-focusing can be a concern, especially at close range, the VISERA ELITE III automatically focuses on the center 14% of the field of view, making such problems less likely to occur. On the other hand, it should be noted that the automatic focus adjustment may automatically focus on a different part of the image than what is being viewed, and manual adjustment may be required as in the past. Also, when the camera moves quickly and significantly, the automatic focus adjustment may not be able to keep up.



Examples of EDOF
The depth of field has been deepened so that blood vessels in the foreground and background, which are outside the center of the field of view, are now in focus.

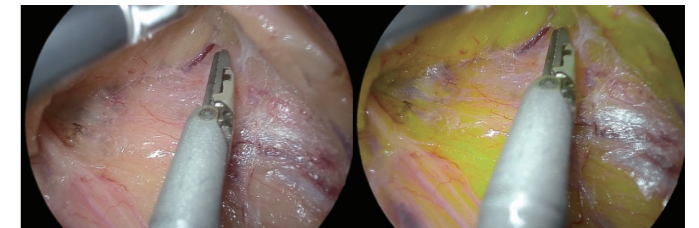
Yellow Enhancement Function

The yellow enhancement (YE) function emphasizes yellow; the YE function changes the appearance by performing color conversion as shown in the figure. As a result, areas that appear pale yellow on the screen become completely yellow, and tissues with a strong yellow component are emphasized and can be observed. Below are some scenes where YE observation may be useful.



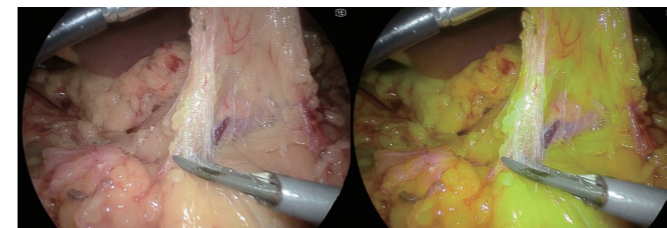
Application to adhesion debridement

Boundaries can be emphasized when performing adhesion dehiscence of the large mesh and abdominal wall.



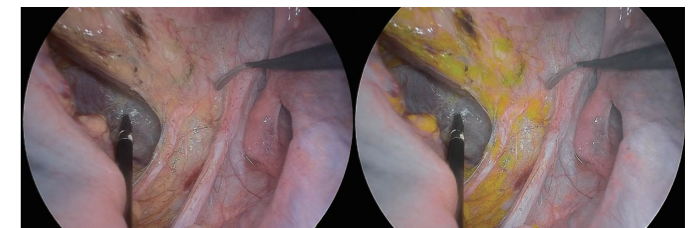
Distinguishing the appropriate layer of dissection

Colorectal cancer surgery is a procedure that focuses on dissection with an awareness of the adherent fascia. The difference in the visibility of the adipose tissue through the adherent fascia can be used to enhance the boundaries with the YE function.



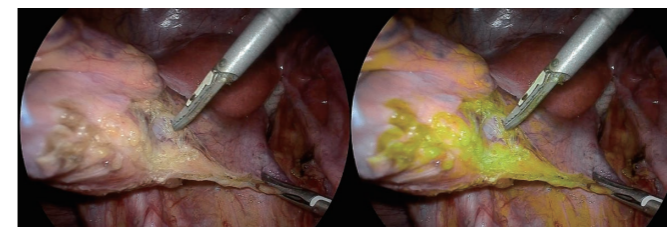
Distinguishing between pancreatic tissue and fat

The degree of yellowing differs between adipose and pancreatic tissue. Even a pancreas embedded in fatty tissue may be easier to visualize using the YE function.



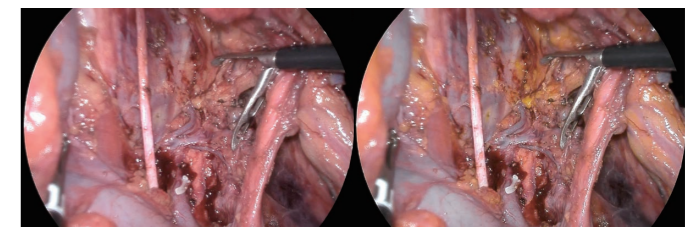
Identification of nerve tissue

Nerve tissue buried in adipose tissue can be identified. This may be useful for identifying the inferior abdominal nerve and bladder branches.



Application to mesorectal dissection

The mesorectum is composed mainly of yellow fatty tissue, whereas the rectal wall contains little fatty tissue. Therefore, during mesorectal dissection, YE observation can clearly delineate the boundary between the rectal wall and fat within the mesorectum. This is especially useful when the boundary is difficult to identify due to obesity, or when explaining the procedure to a novice.



Confirmation of fatty tissue remnants after dissection

After lymph node dissection, the technique can be applied to confirm the presence of fatty tissue remnants that suggest lack of dissection. This is useful in areas where it is difficult to identify the boundary between the fatty tissue and the sacral nerve trunk, such as the anterior aspect of the sacral nerve trunk, because objective information can be obtained.

3 Versatile IR Fluorescence Observation

IR fluorescence observation can be performed in three modes: white overlay IR, IR + magenta, and IR alone. In addition, gain control can be performed in three steps, allowing IR fluorescence observation while controlling the display according to the purpose.

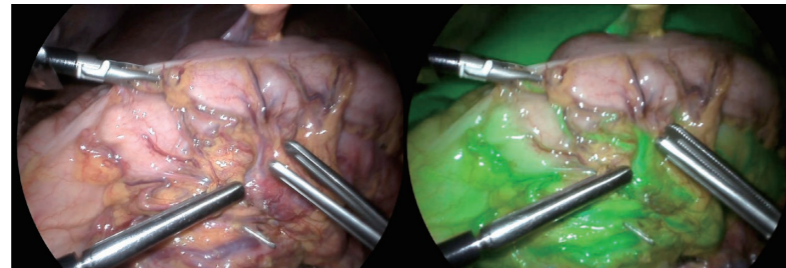
Confirmation of Blood Flow and Blood Vessels

Evaluation of blood flow in the intestinal tract

Blood flow evaluation after sigmoid colon resection was performed using white overlay IR after intravenous injection of 4 mg/body. Observation at high gain is good at the beginning of luminescence, but since luminescence becomes too strong over time, changing to medium gain during the process allows well-balanced observation of luminescence from tissues and blood vessels. When observing only blood vessels, IR+Magenta also emphasizes blood vessels and is easy to observe.

Confirmation of blood vessel run

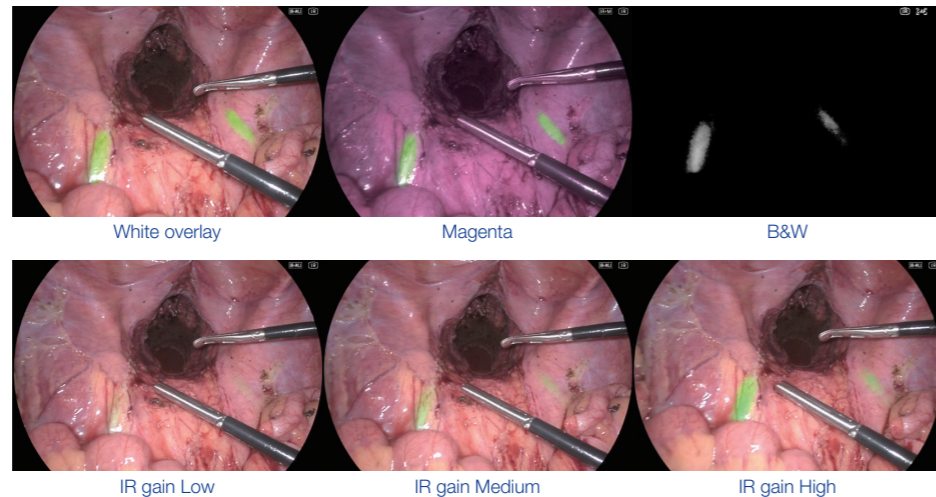
We injected 1 mg/body intravenously and observed blood vessels in the mesentery of the small intestine in order to extend the J-shaped ileal pouch in total proctocolectomy and ileal J-pouch anal anastomosis. When observed with low gain, the luminescence of the mesentery membrane was suppressed and only the blood vessels could be observed.



Importance of Intraoperative Intestinal Blood Flow Evaluation by IR
In the left photograph, the intestinal color tone appears to be preserved, but in the right photograph using white overlay IR observation, a clear luminescence non-region was observed, diagnosing poor intestinal blood flow.

Identification of the Ureter

When a fluorescent ureteral catheter is inserted and IR fluorescence observation is performed, the ureter can be clearly identified even with white overlay IR. It is possible to perform the surgery as it is, but it should be noted that the image quality is slightly degraded in this case.



4 High-quality 3D Images

VISERA ELITE III has an up-conversion function in the system itself. The up-conversion function refers to a function that converts the image signal from the scope into a higher quality image and outputs it. For example, with 4K up-conversion, images obtained with an HD scope that is not 4K compatible can be supplemented to 4K quality and output as near 4K images. Current 3D scopes (ENDOEYE RIGID 3D / ENDOEYE FLEX 3D) are not 4K-compatible, but this up-conversion function allows 3D images to be observed in near 4K quality, which is expected to enable more accurate spatial understanding and lead to more precise and speedy surgery.

The current 3D scopes do not support IR fluorescence observation, but we expect that the next-generation models will feature further improvements in image quality and IR fluorescence observation capabilities.

5 Explanation of Each Surgical Procedure

The following is a general description of the procedure for each technique.

Right Hemicolectomy of the Colon

1) Preoperative confirmation of arteriovenous anatomy

Preoperative dynamic CT is performed to ascertain the arteriovenous anatomy.

2) Grasping the ileal artery and mobilization of the right colon

The ileocecal artery is grasped, the hollow below it is incised, and the right side of the colon is mobilized.

3) Vascular processing and surgical trunk dissection

The vessels are dissected (arteriotomy and venotomy), paying attention to the anatomy of the vessels confirmed preoperatively. Then, the surgical trunk is dissected.

4) Confirmation of the surgical trunk and dissection of the collateral right colon vein

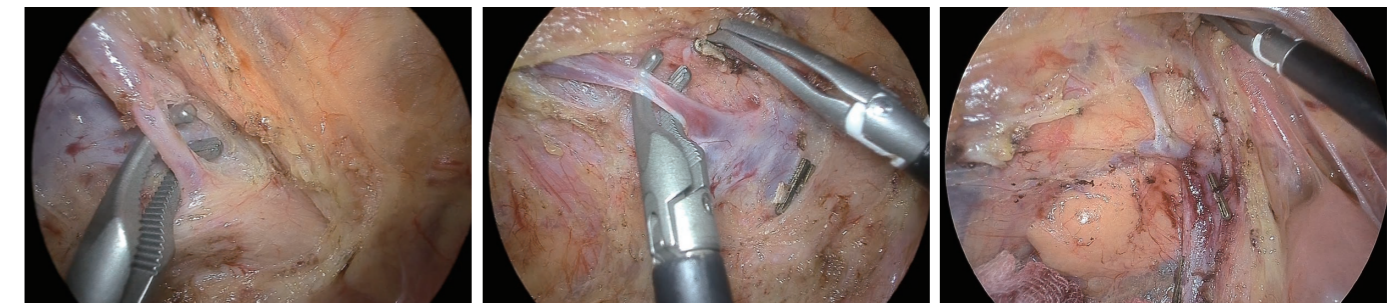
While fully exposing the pancreatic head, the surgical trunk is confirmed and the collateral right colon vein branching from it is dissected (Figure GCT, end of dissection).

5) Mobilization from the hepatic kyphosis (Fig. Mobilization of hepatic kyphosis) to the ileocecal area, mesenteric processing

If necessary, confirm blood flow using ICG (Fig. ICG).

6) Anastomosis

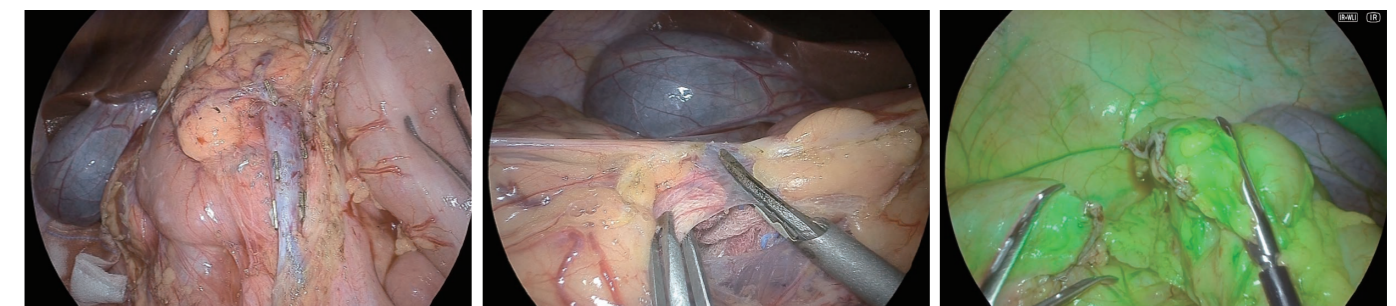
Anastomosis is performed with a functional end-to-end anastomosis. It may be performed extracorporeally or intracorporeally.



Right hemicolectomy (arterial dissection)

Right hemicolectomy (intravenous dissection)

Right hemicolectomy (GCT)



Right hemicolectomy (end of dissection)

Right hemicolectomy (hepatic flexure)

Right hemicolectomy (ICG)

Transverse Colon Resection

Basically, surgery is performed mainly through the cephalic approach.

1) Preoperative confirmation of arteriovenous anatomy

Dynamic CT is performed preoperatively to ascertain the arteriovenous anatomy. In particular, the anatomy of the accessory middle colonic artery and vein (the first jejunal vein, the vein returning from the left side of the transverse colon) must be thoroughly confirmed.

2) Release of omental bursa and dissection of inferior margin of pancreas

The inferior margin of pancreas should be widely and firmly dissected (Figure: Dissection of the inferior margin of pancreas).

3) Confirmation of the superior mesenteric vein

The superior mesenteric vein is located in the center of the lymph node dissection and should be roughly located (Figure SMV).

4) Mobilization of hepatic and splenic curvatures

Mobilization of the hepatic kyphosis and splenic kyphosis is performed as necessary (Fig. Mobilization of hepatic kyphosis and splenic kyphosis).

5) Dissection of the collateral middle colon artery

The collateral middle colonic artery is dissected from the cephalic side (Figure: End of collateral middle colonic artery dissection and dissection).

6) Middle colonic artery dissection

The middle colonic artery is dissected from the caudal side.

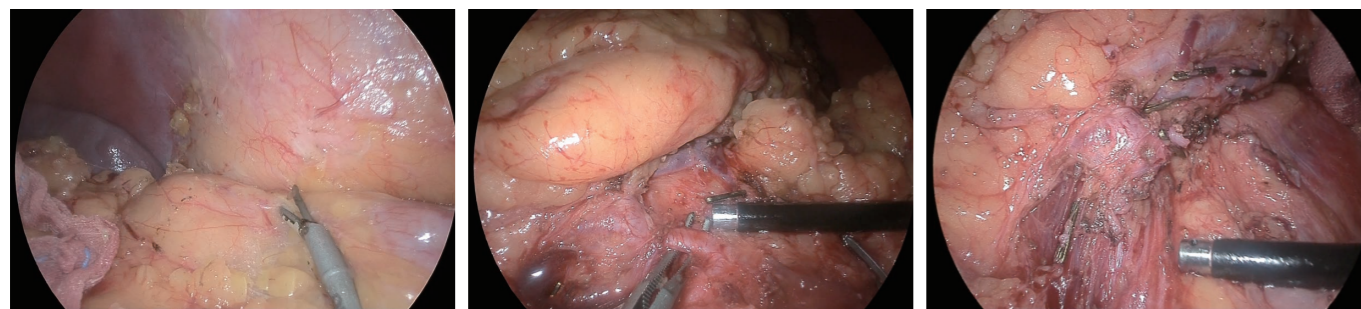
7) Anastomosis



Transverse colectomy (subcutaneous engraftment)

Transverse colectomy (SMV)

Transverse colectomy (hepatic flexure)



Transverse colectomy (splenic flexure)

Transverse colectomy (paramedian mesocolic artery dissection)

Transverse colectomy (end of dissection)

Sigmoidectomy and Anterior Resection

1) Mobilization of the sigmoid mesentery

The inferior mesenteric artery and mesorectum are elevated ventrally and enter the anterior layer of the ureteral inferior abdominal fascia.

2) Dissection of the inferior mesenteric artery (Fig. IMA dissection)

The incision and dissection are made in a cephalic direction, paying attention to the running of the inferior abdominal nerve, and the inferior mesenteric artery is dissected.

3) Dissection of inferior mesenteric vein and left colonic artery

The left colon is moved sufficiently, and the inferior mesenteric vein and left colonic artery are dissected.

4) Dissection of the posterior rectal space (Fig. Posterior rectal space)

The rectum is firmly retracted, and the sparse connective tissue is firmly removed while performing the dissection.

5) Dissection of the anterior and lateral walls of the rectum

The direction of traction of the assistant is controlled as appropriate, and appropriate tension is applied to the area to be dissected.

6) Dissection of the mesorectum and intestine (Fig. Mesorectal dissection)

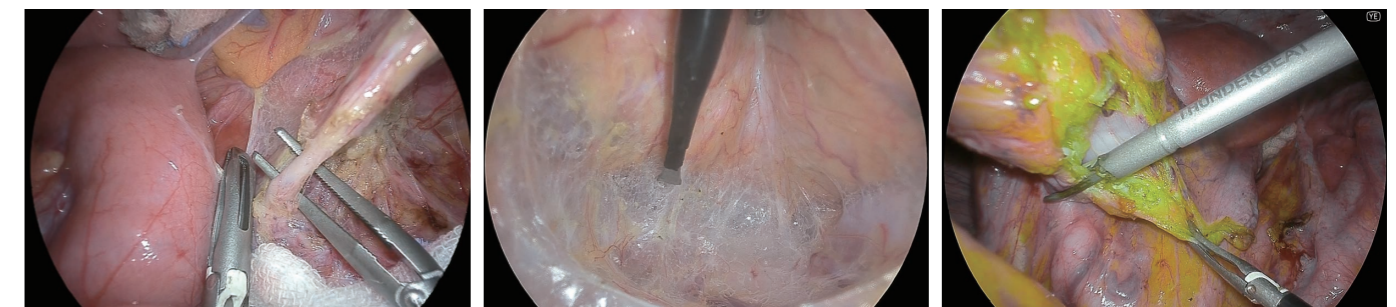
The incision is made from the right side of the rectum. The YE function is used to clearly identify the boundary between the mesorectum and the intestinal tract.

7) Lateral lymph node dissection (lateral dissection 1 and 2)

Conduct the dissection with awareness of the three layers of the ureteric inferior abdominal fascia, the bladder inferior abdominal fascia, and the internal obturator muscle. Expose the internal iliac artery and vein, and firmly determine the extent of dorsal dissection.

8) Anastomosis (Fig. Rectal ICG)

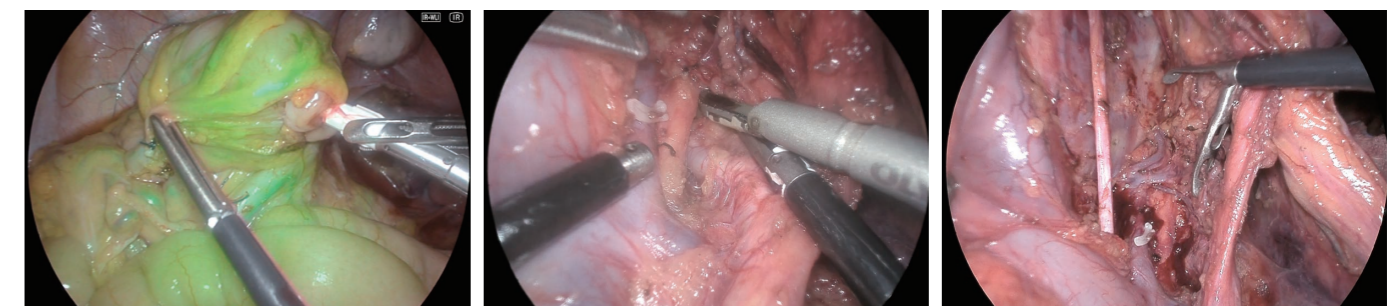
Before anastomosis, blood flow is evaluated at the iliac segment using IR fluorescence observation. Anastomosis is performed by double stapling at each end.



Sigmoidectomy (IMA resection)

Sigmoidectomy (posterior rectal cavity)

Sigmoidectomy (rectal mesenteric resection)



Sigmoidectomy (ICG)

Lateral dissection 1

Lateral dissection 2

Total Proctocolectomy with TaTME

1) Mobilization of the right-sided colon

Mobilization of the right-sided colon by retroperitoneal approach.

2) Dissection of the mesentery of the transverse colon

The splenic flexure is firmly mobilized, the ICA is preserved, and a hole is made in the right sided mesentery. The transverse colon is pulled caudally, and the right side of the transverse colon mesentery is dissected from the right side to the left side at once.

3) Transfer of the left-sided colon and dissection of the inferior mesenteric artery

The left colon is transferred. The height of the inferior mesenteric artery is determined according to the presence or absence of tumor. If lymph node dissection is not performed, a sealing device is used for clipless dissection.

4) Rectal dissection and specimen removal from the anus by two-team surgery

Two teams of surgeons perform rectal dissection with TaTME. Basically, the rectum is dissected in the TME layer, but if no tumor is detected, the rectal wall may be exposed while leaving the mesorectum intact for functional preservation. The end of the ileum is dissected using a linear stapler, and the specimen is removed transanally.

5) Mesenteric processing for ileal sac extension

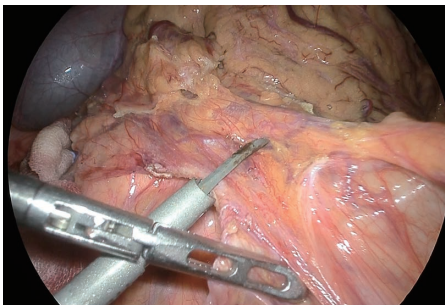
Using the illumination method or ICG, blood flow in the small intestine is checked, and the mesentery is extended while taking care to avoid vascular injury.

6) Construction of J-shaped ileal pouch

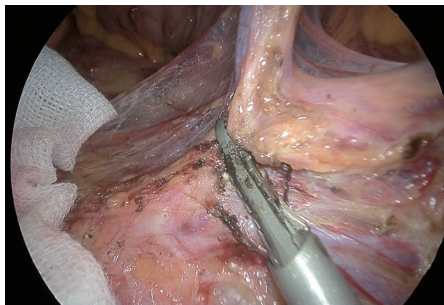
A linear stapler is inserted transanally to construct a J-shaped ileal pouch in the body cavity.

7) Anastomosis

Anastomosis is performed by hand or using a stapler.



Total proctocolectomy (transverse intercolonic resection)



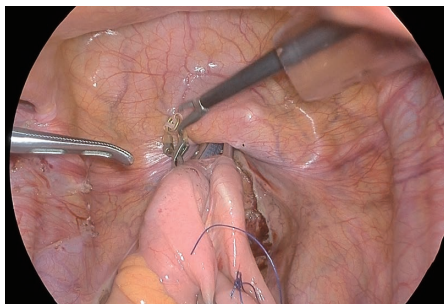
Total proctocolectomy (IMA resection)



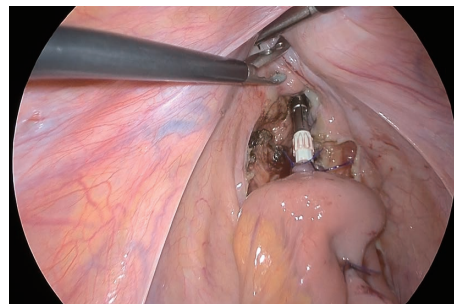
Total proctocolectomy (taTME)



Total proctocolectomy (extension)



Total proctocolectomy (ileocecal sac formation)



Total proctocolectomy (anastomosis)

Conclusion

I realized that the evolution from endoscopes that simply replace the human eye for magnification to endoscopes that provide new information that cannot be captured by the human eye has begun. I myself have not yet fully mastered the functions of the VISERA ELITE III. I look forward to working together with many surgeons in friendly competition to report new innovations as this product penetrates the market in the future.

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