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Case Report

# Single-Incision Laparoscopic Sigmoidectomy With Boari Flap Construction for Advanced Colon Cancer With Ureteric Invasion: A Case Report

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**Urinary tract resection is the only procedure that can cure colorectal cancer that directly invades the ureter. In these cases, open surgery is commonly used. Here, we describe our experience of a case of sigmoidectomy following Boari flap construction with single-incision laparoscopic surgery (SILS) for advanced colon cancer with ureteric invasion. A 68-year-old woman was referred to our hospital with left flank pain. Left hydroureteronephrosis was detected on ultrasonography. Computed tomography revealed a solid mass in the sigmoid colon and hydroureteronephrosis due to swelling of a mesenteric lymph node. Computed tomography detected no signs of distant metastasis. Colonoscopy revealed an ulcerated, bleeding, and stricturing lesion in the sigmoid colon, which was identified as an adenocarcinoma with a moderate degree of differentiation at histological examination. Under general anesthesia, the patient was placed in the Trendelenburg semi-right lateral position. An umbilical incision was made for the insertion of a single multichannel port for SILS. Sigmoidectomy and Boari flap reconstruction were performed. There were no perioperative complications. The total operating time was 572 minutes (including Boari flap procedure of 174 minutes), and estimated blood loss was 200 mL. Single-incision laparoscopic sigmoidectomy with Boari flap construction is technically feasible with sigmoid cancer and ureteral invasion.**

*Key words:* Laparoscopic Boari flap – Colon cancer – Single-incision laparoscopic surgery

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Single-incision laparoscopic surgery (SILS) has been successfully introduced for colectomy.[1–5] However, the procedure is technically difficult for cases involving direct tumor invasion such as ureteric invasion. In these cases, ureter dissection and reconstruction were needed. Bladder flap (Boari flap) construction combined with ureteroneocystostomy is an appropriate technique for repairing injuries to the distal ureter that result in shortening of the ureter.[6] However, few reports have been published about multi-port or single-port laparoscopic and robotic surgery for construction of the Boari flap for urological cases,[7–11] and no report on SILS sigmoidectomy with Boari flap construction for colon cancer exists. Laparoscopic approaches may decrease surgical trauma and result in fewer perioperative complications and a faster postoperative recovery compared with conventional open surgery. In this study, we report a case of curative sigmoidectomy following Boari flap construction with SILS for advanced colon cancer with ureteric invasion.

*Patient and methods*

A 68-year-old woman was referred to our hospital with left flank pain. Physical examination and urine and blood tests revealed no abnormality. Left hydroureteronephrosis was detected on ultrasonography. Computed tomography (CT) revealed a solid mass in the sigmoid colon (Fig. 1a) and hydroureteronephrosis (Fig. 1b) due to swelling of a mesenteric lymph node (Fig. 1c). No signs of distant metastasis were detected on CT. Colonoscopy revealed an ulcerated, bleeding, and stricturing lesion in the sigmoid colon (Fig. 2), which was identified as an adenocarcinoma with a moderate degree of differentiation at histological examination. The level of carcinoembryonic antigen (CEA) was 21.7 ng/mL. The surgeons are specialists in colorectal cancer and are registered with the Japan Society for Endoscopic Surgery. The surgeons also have training in procedures such as ileal conduit creation and urethrovesical anastomosis for pelvic exenteration, and experience with laparotomic surgery using the psoas hitch method, the Boari flap method, and ileal ureter replacement with ileovesicostomy. The surgeons have also performed procedures such as laparoscopic pelvic exenteration and laparoscopic ureterectomy with ureterovesical anastomosis. The preoperative images and methods of resection and reconstruction were discussed with the urologist. In addition, following consultation with the urologist, a double-J stent was not placed because it would hinder surgical operations, and because renal function before surgery was maintained.

*Surgical technique*

Under general anesthesia, the patient was placed in the Trendelenburg semi-right lateral position. The surgeon and cameraman stood on the right side of the patient. First, a wound protector (Lap protector, LP, Hakko Co, Ltd, Tokyo, Japan) was inserted through a 35-mm transumbilical incision (Fig. 3a). Next, a single port access device (EZ-access; Hakko Co., Ltd.) was mounted to the wound protector and

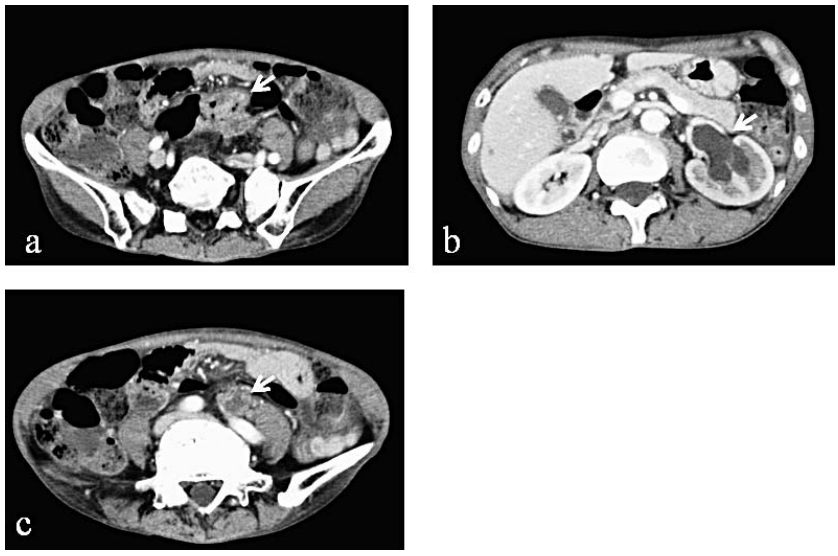


**Fig. 1** Computed tomography revealed a solid mass in the sigmoid colon (a) and a hydroureteronephrosis (b) due to swelling of a mesenteric lymph node (c).

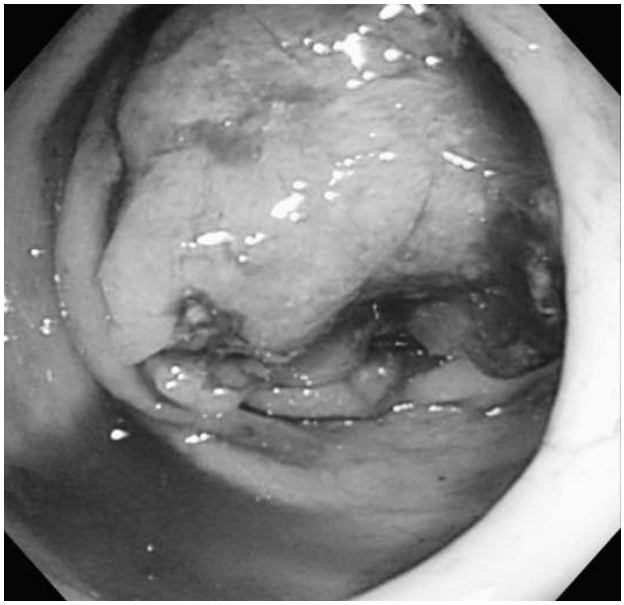

**Fig. 2** Colonoscopy revealed an ulcerated, bleeding, and stricturing lesion at the sigmoid colon.

three 5-mm ports were placed (Fig. 3b). The operative procedure and instruments were the same as those used in standard laparoscopic sigmoidectomy using a flexible 5-mm scope (Olympus Medical Systems Corp., Tokyo, Japan). The operation was performed using surgical techniques similar to those in the standard laparoscopic (medial-to-lateral) approach. The inferior mesenteric artery and the inferior mesenteric vein were skeletonized, clipped and divided. Then, we dissected downward from the mesenteric window to the pelvis on the right side of the rectum. The next step was mobilization of the sigmoid colon up to the splenic flexure. The descending colon and sigmoid colon was pulled anteromedially to enable clear identification of the left ureter. The left ureter was obstructed by an enlarged mesenteric lymph node containing metastasis at the level of crossover of the iliac vessels, and was cut at the surgical proximal margin. Following the proximal margin of the ureter, the distal ureter was traced downward to the bladder and was ligated with 2-0 Vicryl. The ligature was cut and the ureter was removed with the sigmoid cancer specimen. Routine sigmoidectomy was then performed.

*Boari flap procedure*

The schematic image of Boari flap procedure was shown in Fig. 4a. A 6-Fr single J stent (Dretler Ureteroscopy Stent Set, Cook Urological, Spencer, Indianapolis) was introduced through the abdominal wall and guided into the left renal pelvis under laparoscopic guidance. The stent in the ureter was sutured. The ligated left lower ureter was identified and transected 5 cm above the vesicoureteric junction. The ligatures were cut and the proximal ureter was released. The peritoneum was incised lateral to the medial umbilical ligaments, and the lateral incisions were joined across the midline. By combining a blunt and sharp dissection, the bladder was completely dropped. The bladder was then filled with 200 mL of sterile normal saline. The apex of the bladder was fixed to the psoas muscle with 2-0 vicryl suture for tension-free anastomosis (Psoas hitch technique). A cut line was made on the anterior wall of the bladder in such a way as to construct a bladder flap with its apex pointing toward the foot end of the patient (Fig. 4b). The flap was converted into a tube and the lower end of the spatulated ureter was anastomosed to the end of the Boari flap tube with single-layer interrupting suture, using 3-0 vicryl (Fig. 4c). No attempt was made to create a submucosal tunnel as an antireflux mechanism. A 6-Fr single J stent was inserted through the suture line and the bladder was closed (Fig. 4d). The procedure was concluded with an evaluation of the

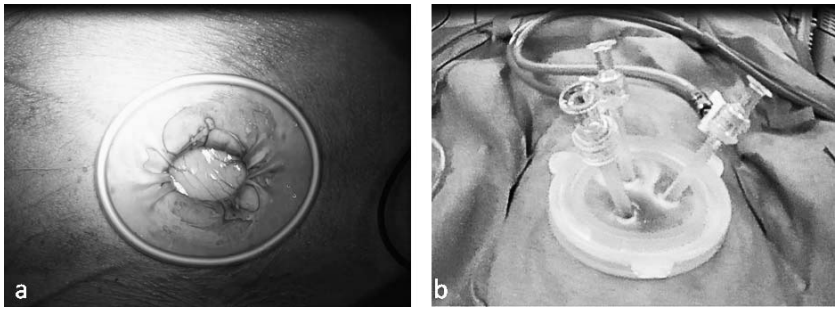


**Fig. 3** (a) Lap protector inserted through a 30-mm transumbilical incision. (b) Three 5-mm ports placed in EZ-access.

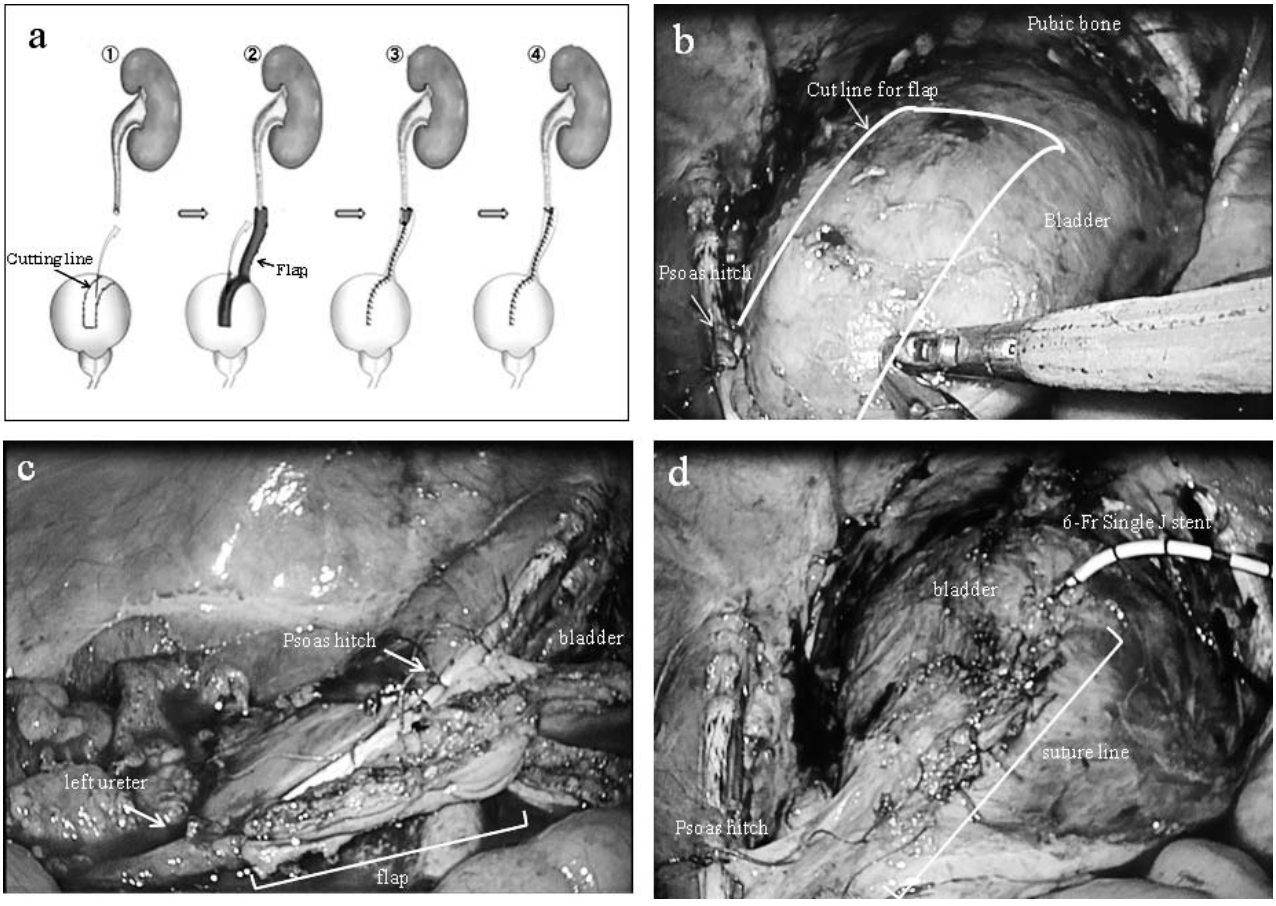


**Fig. 4** (a) Schematic image of Boari flap procedure. (b) Marking of the bladder flap. White line showing a cut line. (c) The flap was converted into a tube and the lower end of the ureter was anastomosed to the end of the Boari flap tube. (d) A 6-Fr Single J stent was placed through the suture line and the bladder closed.

tightness of the bladder by filling it with 300 mL of saline solution.

## Result

Total operating time was 572 minutes (including Boari flap procedure of 174 minutes) and the estimated blood loss was 200 mL. The final view is shown in Fig. 5. At postoperative day 7, urography of the single J stent showed good passage through the Boari flap tube (Fig. 6). The pathology report showed a moderately differentiated adenocarcinoma of the sigmoid colon with the staging of pT4N1M0 stage IIIb and tumor-free margins. Resected ureter was invaded microscopically by adenocarcinoma (Fig. 7). At the strong request of the patient, adjuvant chemotherapy was not performed after surgery. Ten months have passed since surgery, but blood tests and contrast-enhanced CT

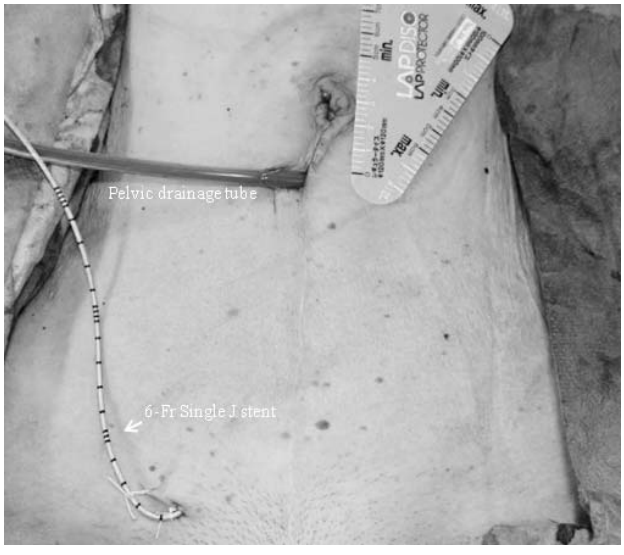


**Fig. 5** Final view of SILS sigmoidectomy + Boari flap.

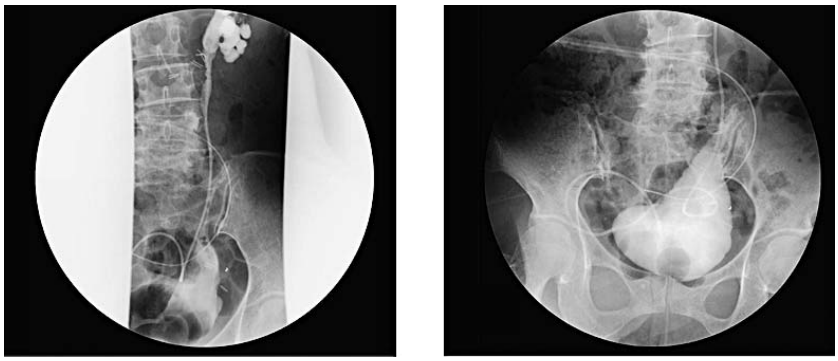

**Fig. 6** Single-J stent urography 7 days after operation.

scans have found no recurrence of colon cancer, and no hydronephrosis or complications of the urinary tract are present.

## Discussion

The use of minimally invasive surgery has been widely accepted and the number of ports has been reduced to decrease parietal trauma and improve cosmetic results. The application of SILS for colorectal surgery has recently emerged in the literature.[1–5] Urinary tract resection is the only procedure that can cure colorectal cancer that directly invades the ureter.[12] In these cases, open surgery is commonly used. Multiport laparoscopic ureter reconstruction was first reported in 1994.[13] Previous papers have highlighted the minimal invasiveness of the laparoscopic approach compared with open reconstructive surgery.[13–17] In our case, end-to-end anastomosis was not performed because of the ureteral defect; instead, we performed the Boari flap method for a tension-free anastomosis. An antireflux mechanism is one of the components of the ureteral reconstruction procedure. The most commonly used method is the submucosal tunnel technique, which requires some experience in laparoscopic surgery. However, a significant ureteral defect prevents the application of antireflux methods.[18] Therefore, we performed a simple ureteroneocystostomy in our patient who had significant ureteral defects. We also inserted a single-J catheter at our facility, and drew it out of the body from the bladder via a cutaneous fistula. The advantages of this method are that urography of the urinary tract can be performed easily after the operation and that the catheter can be removed easily, with no need for ureteroscopy. Performing complex anastomoses with the use of the Boari flap and vesico-psoas hitch is reportedly the most difficult, with an average operative time of 247 minutes for multiport laparoscopic surgery, as reported by Gözen *et al*.[17] In robotic surgery, Musch *et al*[8] reported their experience of 16 patients, with a median surgical time of 260 minutes. In the SILS procedure, Khoder *et al*[11] reported a case of ureteric stricture treated with Boari flap, with surgical time of 365 minutes and reported that patient undergoing SILS Boari flap had similar surgical outcomes and comparable convalescent periods except for prolonged surgical time. Our results with the Boari flap using SILS compare favorably with those of multiport or robotic laparoscopic Boari flap construction. To our knowledge, this is the first report of SILS sigmoidectomy with Boari flap construction for advanced colon cancer.

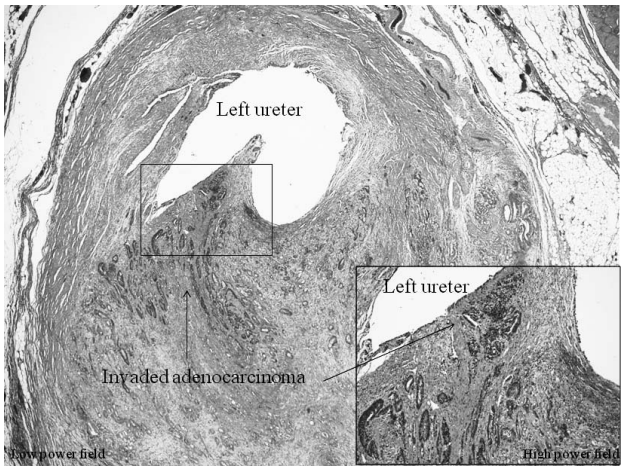


**Fig. 7** Histopathological findings showed a ureteric invasion of the sigmoid colon adenocarcinoma.

Because the same instruments as those used in a conventional laparoscopic surgery are used for the SILS-Boari flap that we performed, there is no need to prepare special instruments, such as those required for a robotic surgery. Therefore, any institution can incorporate this technique. However,

it becomes important to fix the structure because there are no assistants. In our SILS technique, we perform psoas hitch technique for fixing the bladder before construction of the flap so that the subsequent operation can be performed more easily. This procedure also allows us to construct a flap in a shallow position of the pelvis. Therefore, interference of triangulation with a camera and clamps can be avoided. Because laparoscopic interrupted suture is frequently used when constructing a Boari flap tube, prior training is required. Although reconstruction using Boari flap is common in the field of urology, it is unfamiliar for colorectal surgeons. However, if colorectal surgeons acquire this technique, they may be able to perform curative resection even in patients with ureteric invasion by using minimally invasive procedures.

In conclusion, we documented the feasibility of SILS sigmoidectomy with Boari flap construction for advanced sigmoid cancer. This procedure is technically feasible for the treatment of advanced sigmoid cancer with ureteral invasion. Further studies are needed to confirm the advantages of SILS sigmoidectomy with Boari flap construction over conventional laparoscopic surgery.

## Acknowledgments

The authors have no conflicts of interest or financial ties to disclose.

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