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Boari Flap Urinary Tract Reconstruction for Rectosigmoid Cancer with Ureteral Invasion: Report of a Case

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Introduction: The Boari flap technique is a unique urinary tract reconstruction procedure performed after resection of the urinary tract. However, few previous reports have described the application of this technique to gastrointestinal cancer. Moreover, we have not found any papers describing the long-term prognosis. We report a case of right ureteral tract resection followed by Boari flap reconstruction for rectosigmoid carcinoma, with survival for 108 months without any urologic complications.

Case presentation: A woman in her 50s was diagnosed with rectosigmoid cancer by a local physician and referred to our institution. Computed tomography scans revealed right hydronephrosis caused by rectosigmoid cancer invasion at the lower two-thirds of the right ureter. During laparotomy, massive lymphatic infiltration from the primary lesion to right ureter was observed. After primary tumor resection with lower ureter excision, the Boari flap procedure was performed to reconstruct the ureteral deficit. The postoperative course was uneventful, and she was discharged on postoperative day 20. The patient has been seen every 4 months for 9 years with no recurrence or unpleasant symptoms.

Discussion: This technique is usually performed to manage specific conditions such as ureteral stenosis caused by ureteral calculi, retroperitoneal fibrosis, and gynecologic disorders. This procedure should be reconsidered as a possible option for gastrointestinal

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malignant cases instead of nephrostomy or cutaneous ureterostomy, given the low rate of complications and high patient satisfaction.

Conclusion: The Boari flap technique is particularly useful for bridging between the ureter and bladder in cases of colorectal malignancy with combined resection of the lower urinary tract.

Key words: Boari flap – Rectosigmoid cancer – Urinary tract reconstruction

The Boari flap technique was originally developed for urinary tract reconstruction (UTR) following resection of a lower ureter. This method has typically been performed to treat ureteral obstruction caused by ureteral calculi, retroperitoneal fibrosis, and gynecologic disorders.[1,2] However, few previous reports have described the application of this technique for combined ureter resection in cases of colorectal cancer. In addition, the long-term prognosis after this technique has not been reported.[3,4] We present a case of rectosigmoid cancer that had infiltrated the lower two-thirds of the right ureter and was managed by performing the Boari flap procedure.

Case Presentation

A woman in her 50s was examined by her local physician for right lower back pain in June 2012. Abdominal contrast-enhanced computed tomography (CE-CT) scans revealed a large pelvic tumor, and the patient was referred to our institute for further investigation. She had no surgical or family history of note. Physical examination revealed a hard tumor about 10 cm in diameter in the lower abdomen. Elevated serum levels of carcinoembryonic antigen and carbohydrate antigen 19-9 level were observed (7.4 and 387 ng/mL, respectively). A type 4 tumor was detected on colonoscopy, 15 cm from the anal verge, and extending 10 cm into the oral side of sigmoid colon (Fig. 1A). Pathologically, the tumor was diagnosed as adenocarcinoma. Barium enema showed a 10-cm luminal narrowing along the long axis (Fig. 1B). CE-CT revealed an ill-defined tumor anterior to the sacrum (Fig. 2A). Right hydronephrosis was noted because of cancerous invasion to the lower two-thirds of the right ureter (Fig. 2B). No metastatic lesions were detected in the lungs, liver, or peritoneum. Contrast-enhanced magnetic resonance imaging (MRI) identified massive direct infiltration and lymphatic invasion into the right mesentery and retroperitoneum (Fig. 3A and 3B). Although extensive tumor invasion was suspected, we performed surgery without neoadjuvant chemotherapy or radiotherapy because there were no unresectable factors such as peritoneal dissemination or infiltration of major vessels. Before surgery, a double J catheter was placed in the stenotic right ureter. On laparotomy, the primary lesion was seen directly invading into the right ureter. We performed low anterior resection with right ureterectomy and regional lymph node dissection. A defect of approximately 10 cm in the ureteral tract resulted from ureteral resection. This long deficit in the ureter made end-to-end anastomosis impossible, so the Boari flap technique was applied for UTR. We made a 10-cm incision from the apex to the anterior bladder wall and performed remnant ureter-to-bladder end-to-end anastomosis (Fig. 4A). After passing a patency catheter from the bladder to the kidney, a small-bore tube was created by interrupted sutures using 4-0 bladed polyglactin (4-0 Vicryl, Ethicon Inc, Somerville, New Jersey) (Fig. 4B). Finally, instrumental colorectal anastomosis was performed. Total blood loss was 535 g, and duration of surgery was 337 minutes. The patency catheter was removed on postoperative day (POD) 13 after contrast radiography confirmed the absence of urinary leakage or stenosis. The patient was discharged on POD 20 without any complications. Macroscopic findings showed a rectal tumor with a maximum diameter of 9 cm (Fig. 4C) and direct invasion to the right ureter (Fig. 4D). Microscopic examination revealed a moderately differentiated adenocarcinoma with right ureteral infiltration. No lymph node metastases were seen in any of the 24 lymph nodes harvested. The final diagnosis was stage 2 according to the Union for International Cancer Control TNM staging system.[5] After 5-fuluorourasil–based adjuvant treatment for a year, the patient has been followed for 9 years without recurrence or urologic dysfunction.

Discussion

UTR is sometimes required in various situations of urologic and gynecologic disorders, such as ureteral

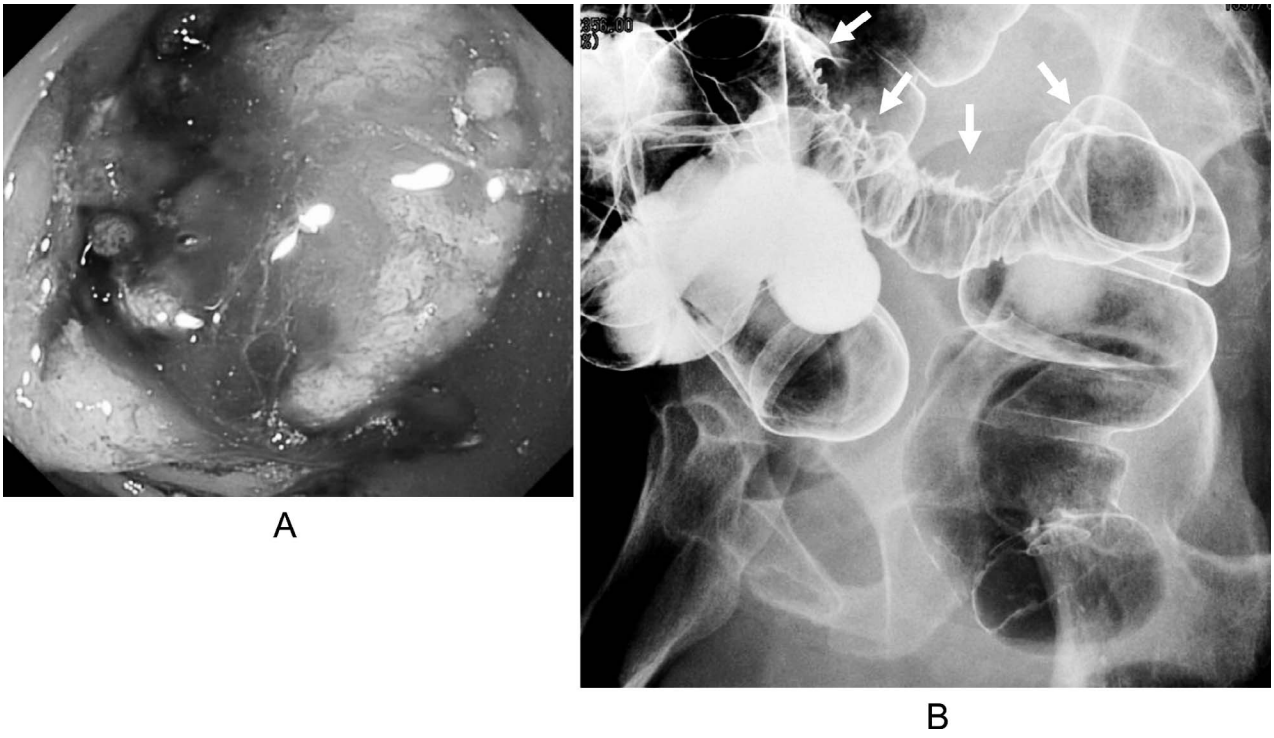

Fig. 1 (A) Sigmoidoscopy: A type 4 tumor occupying two-thirds of the lumen was detected at rectum. (B) Barium enema: Luminal narrowing was observed, affecting 10 cm extended from the rectum to sigmoid colon (white arrows).

lithiasis, retroperitoneal fibrosis, trauma, iatrogenic injury, and intrapelvic malignancies. Bladder wall infiltration from a rectosigmoid cancer is relatively common, but ureteral infiltration is much rarer.[1] The survival rate of these cases is reportedly comparatively lower. Russo *et al*[2] described a 3-year disease-specific survival rate of 34%, and Stief *et al*[6] reported a 5-year overall survival rate of 24.4% after curative resection for urinary tract–invading colorectal cancer. Although the survival rate is far from satisfactory, curative resection is the only option to achieve cure. In such cases, UTR remains indispensable.

Fig. 2 (A) Enhanced CT scan revealed a rectosigmoid tumor that invaded the retroperitoneum (white arrows). (B) Right ureter showed hydronephrosis (white arrow).

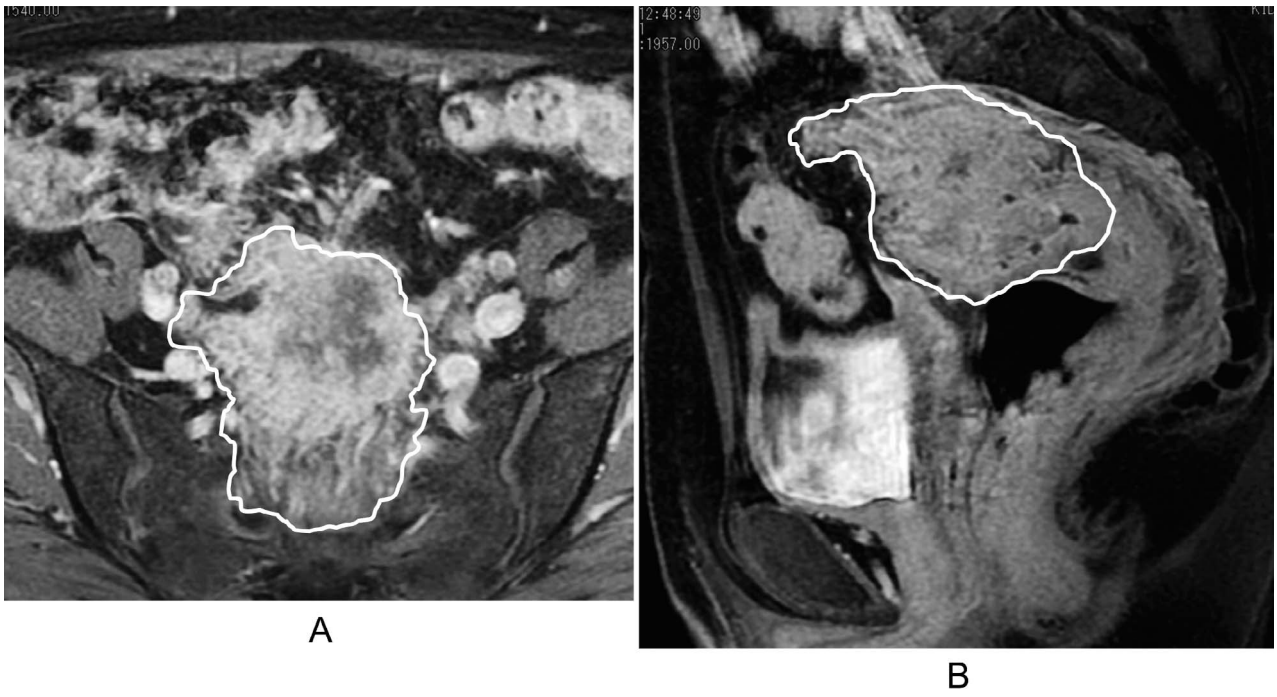

Fig. 3 (A) Enhanced MRI demonstrated a tumor that expanded to the mesentery and retroperitoneum (white line forms the border). (B) Sagittal view of MRI: A giant mass expanded to the sigmoid colon and rectum (white line forms the border).

Various reconstruction procedures have been reported. Ureter-bladder anastomosis is an uncomplicated method used for short defects less than 3 cm in length.[7] For deficits up to 5 cm, the psoas hitch procedure is feasible[8]. This procedure includes ureter-bladder anastomosis with psoas muscle fixation in addition to bladder mobilization. In cases with a defect greater than 5 cm, the Boari flap technique is applicable for urinary reconstruction. The Boari flap technique was first used in 1904 on dogs and was widely applied to humans by Ockerbald.[9] This technique is suitable for longer ureteral defects[10], especially those exceeding 10 cm. Benson *et al*[11] reported the superiority of this method from the perspectives of lower morbidity and favorable quality of life (QOL). The cancer in the present case exhibited an aggressive, infiltrating pattern with the primary rectosigmoid tumor invading to the mesentery and resulting in right ureteral infiltration. Because extensive ureteral resection was necessary to obtain curative resection, we considered the Boari flap the most suitable reconstruction for this situation.

The long-term outcomes of the Boari flap technique for urologic and gynecologic disorders have been presented from many institutions,[10–12] but only 4 case reports have described the use of this technique for reconstruction after resection of gastrointestinal malignancy.[3,4] Tan *et al*[4] reported use of this reconstruction procedure for 1 primary sigmoid colon cancer case and 2 cases of recurrent colorectal cancer. Tokuoka *et al*[3] performed single-incision laparoscopic sigmoidectomy followed by Boari flap reconstruction for sigmoid colon cancer without complications. The duration of the operation was quite long, at 572 minutes, and whether laparoscopic surgery was feasible is controversial.[3]

We evaluated serum levels of tumor markers and image studies every 4 months, and the patient remains free from recurrence as of 9 years after surgery. Moreover, we did not encounter any complications such as ureteral stenosis, hydronephrosis, urinary tract infection, or urinary incontinence. We believed that the favorable postoperative course and QOL are attributable to the selection of the Boari flap procedure. This highly reliable and safe technique is applicable to not only urologic and gynecologic surgeries but also gastrointestinal surgery.

Conclusion

The Boari flap method appears suitable for not only urologic and gynecologic disorders but also gastrointestinal malignancy. This technique is associated

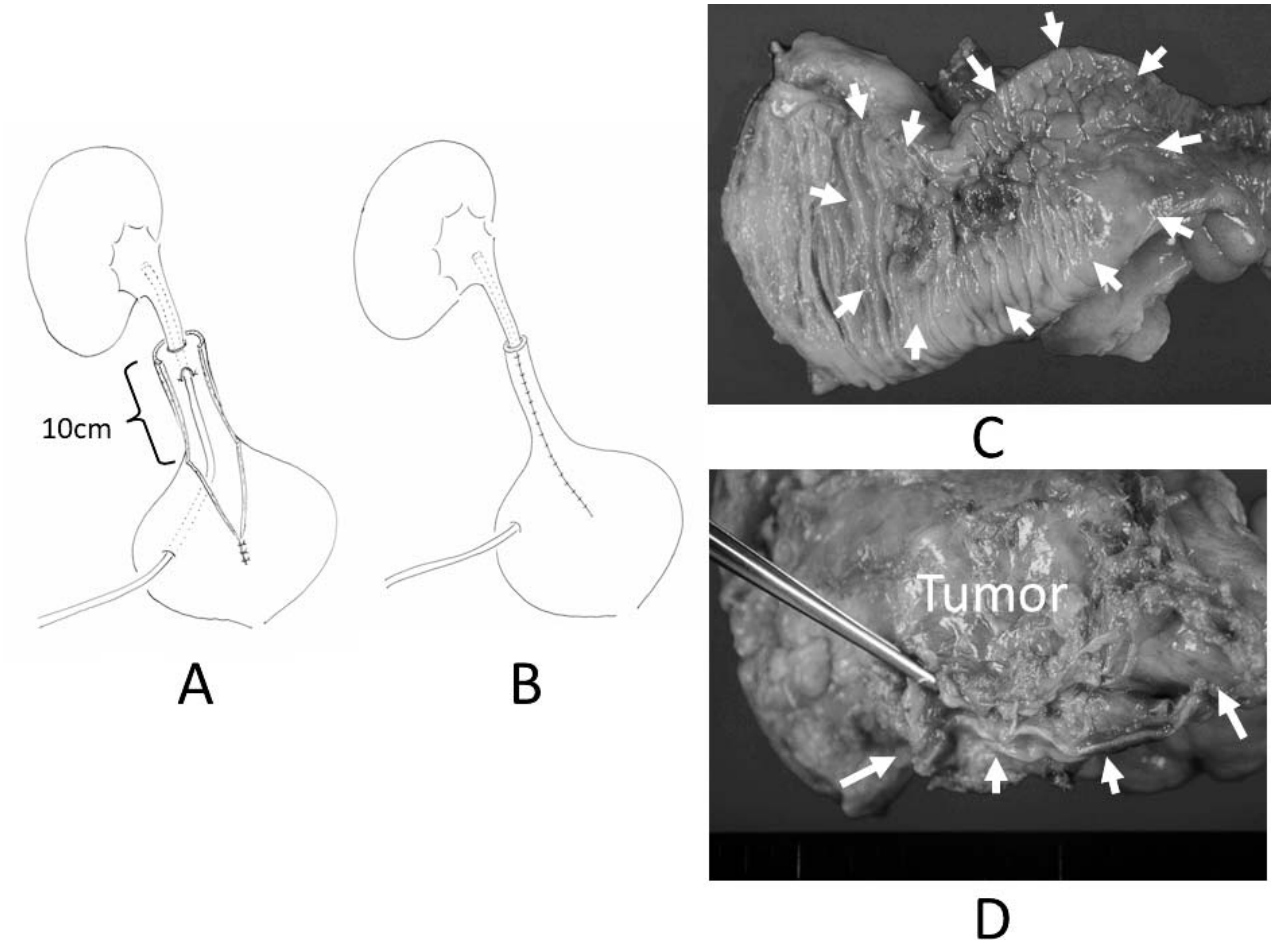

Fig. 4 (A) An approximate 10-cm incision was made on the anterior bladder wall; subsequently, we performed ureter-bladder end-to-end anastomosis with a submucosal tunnel. (B) A cylindrical flap was created, and we successfully finished the procedure. (C) Macroscopic findings of the primary lesion: A 9-cm tumor outspread into the intestinal wall and mesentery (white arrows). (D) Right ureter (white arrows) was involved by the tumor.

with few urinary tract complications, favorable voiding, and extremely high patient satisfaction.

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