

Ureteroarterial Fistula after Urinary Diversion

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Abstract: Ureteroarterial fistula, a serious complication that sometimes arises after urinary diversion surgery, is fatal if untreated. The purpose of this study was to investigate the incidence and course of this condition and seek the method of prevention. We retrospectively reviewed the hospital records of 118 patients who underwent urinary diversion surgery at Saitama Cancer Center between 1994 and 1999. The urological procedure was cutaneous ureterostomy in 82 patients and ileal conduit in 36. Among those patients, four developed ureteroarterial fistula. The urinary diversion procedure used in these four patients was cutaneous ureterostomy and all the ureters had been stented, thus the incidence of fistula formation was 4.9% among the 82 patients with cutaneous ureterostomies. Dacron patch closure of the aortic defect in the first patient resulted in infection of the graft. Ligation of the aorta or iliac artery and extraanatomical revascularization was performed in two. One fistula was directly closed with sutures. Two patients survived the operation. We concluded that the rate of fistula formation between the ureter and a major artery within one year after surgery may reach nearly 5% if a cutaneous ureterostomy is created and the catheterized ureter crosses the major artery. In order to prevent fistula formation, we employed the omental cushion method, in which the greater omentum was interposed between the ureter and aorta or iliac arteries. After adoption of this method, there has been no fistula formation. Further observation is, however, necessary. (Jpn. J. Vasc. Surg., 14: 583–586, 2005)

Key words: Ureteroarterial fistula, Aortoureteral fistula, Urinary diversion, Cutaneous ureterostomy

Introduction

Communication between the ureter and a major artery is a grave complication following urological surgery, and the mortality among reported cases is 37.8%.¹⁾ In particular, treatment of pelvic malignancy requires extensive lymphadenec-

tomy around the iliac arteries, thus exposing them to possible risk of fistula formation. This condition is fatal if untreated, and poses great diagnostic and therapeutic challenges to surgeons. In order to clarify the incidence and course of ureteroarterial fistula, we conducted a retrospective study.

Patients and Methods

Records of patients who underwent urinary diversion surgery at Saitama Cancer Center between 1994 and 1999 were reviewed retrospectively. There were 72 men and 46 women, ranging in age from 26 to 85 years, with a mean age of 63.2 years. The reason for urinary diversion was urological malignancy in 70 patients, colorectal malignancy in 18, gynecologic

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Table 1 Patients with ureteroarterial fistula

| Patient | Indication for the initial operation | Urinary diversion | Artery | Op. to bleeding | Bleeding to intervention | Intervention | Kidney | Results |
|-------------|--------------------------------------|---|--------|-----------------|--------------------------|----------------------|-------------|------------------|
| A 70yo m | Rectal cancer | Cutaneous ureterostomy with ureteroureterostomy | Aorta | 4 mo | 29 days | Dacron patch closure | Nephrostomy | Death (bleeding) |
| B 52yo f | Cervical cancer (recurrence) | Double-barreled cutaneous ureterostomy | Lt CIA | 5 mo | 4 days | Ax-F, ligation | Nephrostomy | Death (sepsis) |
| C 68yo f | Vesicovaginal fistula | Cutaneous ureterostomy with ureteroureterostomy | Lt CIA | 11 mo | 8 days | Direct closure | Nephrostomy | Survived |
| D 65yo m | Rectal cancer (recurrence) | Bilateral cutaneous ureterostomy | Rt CIA | 3 mo | 4 days | F-F, ligation | Nephrectomy | Survived* |

CIA: common iliac artery, Ax-F: axillofemoral arterial bypass, F-F: femorofemoral arterial bypass, ligation: ligation of the aorta in patient B, and of the iliac artery in patient D, *: four months later died of cancer.

logical malignancy in 16, other malignancies in 2, and post-operative urological complications (vesicovaginal fistula, hydronephrosis, contracted bladder) in 12. The method of urinary diversion surgery was cutaneous ureterostomy in 82 patients and ileal conduit in 36.

Results

There were 4 patients with ureteroarterial fistula, giving an incidence of 3.4% (**Table 1**). The reason for the initial operation was rectal cancer in 2 patients, recurrent uterine cervical cancer in 1 and postoperative vesicovaginal fistula in 1. The case of vesicovaginal fistula appeared 5 years and 5 months after surgical treatment and irradiation for uterine cervical cancer. The surgical procedure employed was total pelvic exenteration for the 3 patients with cancer and isolated urinary diversion for the other patient. The urinary diversion procedure used in these 4 patients was cutaneous ureterostomy, thus the incidence of fistula formation was 4.9% among the patients with cutaneous ureterostomies. The ureter crossed the aorta or the common iliac artery in 3 patients with ureteroureterostomy or double-barreled ureteral ostia. In the other patient, the right ureter had been in close proximity to the right common iliac artery. Indwelling ureteral stents had been placed in all patients.

The aorta was the source of bleeding in 1 patient, whereas the fistulae had formed between the common iliac artery and the ureter in the other three. The interval between the initial

operation and bleeding was 3 to 11 months, with a mean of 5.8 months. Bleeding was initially intermittent in all cases.

Three of the patients were febrile at the time of bleeding. The remaining patient was afebrile but her leukocyte count was 10,650/mm³. The duration of bleeding until operative intervention varied from 4 to 29 days. In the first case (patient A), poor appreciation of the condition by the surgeons resulted in a treatment delay, and the definitive diagnosis was made during the operation. The aortic wall had been severely infected and was fragile. Urgent attempts to close the aortic defect with a Dacron patch resulted in eventual detachment of the prosthesis, and the patient bled to death after 9 days. In 2 other patients (patients B and D), preoperative angiography showed opacification of the ureter (**Fig. 1, 2**), and in the remaining patient (patient C), the aorta was visualized during retrograde pyelography (**Fig. 3**). In patients B and D, the aorta and/or iliac artery were ligated and extraanatomic revascularization was performed. In patient C, hemostatic coil placement in the ureter temporarily stopped the bleeding (**Fig. 4**), and a small arterial defect was directly suture-closed later.

In 3 patients the involved ureter was resected and a nephrostomy was created. The affected kidney was removed in the last patient. Patient B died 57 days after the operation due to uncontrolled sepsis. The remaining 2 patients survived the operation and were discharged from hospital. Bleeding did not recur in these patients, but patient D died of



Fig. 1 Preoperative angiogram in patient B. The left ureter is opacified (arrows). The fistula is located between the left common iliac artery and the left ureter.



Fig. 2 Angiogram of patient D. The right ureter (arrows) is visualized through a fistula in the right common iliac artery.



Fig. 3 Patient C. The aorta (clear arrow) is opacified by retrograde pyelography through the left ureter (solid arrow).



Fig. 4 Angiogram of patient C. The bleeding was temporarily stopped by hemostatic coils in the left ureter (arrow). Operative treatment was undertaken later.

peritoneal dissemination of the cancer 4 months later.

Discussion

Our experience suggests that the rate of fistula formation between the ureter and major artery within 1 year after surgery may reach nearly 5% if a cutaneous ureterostomy has been created and the catheterized ureter crosses the skeletonized artery. This observation contradicts the common belief that this complication is very rare.²⁻⁸⁾ In the present series, fistula formation was observed exclusively in patients with cutaneous ureterostomies, although an ileal conduit can also result in this complication,^{2, 4, 9)} and even stenting without

urinary diversion can cause fistula formation.^{3, 6)} Bleeding is usually intermittent at first³⁾ but will eventually result in death.

There may be a pseudoaneurysm between the artery and the ureter,¹⁰⁾ or there may be a direct connection between the two structures. In the latter case, preoperative diagnosis is usually difficult. Although preoperative demonstration of the fistula was possible in 3 of our patients, angiography, intravenous or retrograde pyelography, or computerized tomography often gives negative results.^{2, 8, 11)} Radiological demonstration of the fistula may require multiple projection and even provocative maneuvers,¹²⁾ but this requires a high degree of suspicion and preparation, such as use of a balloon

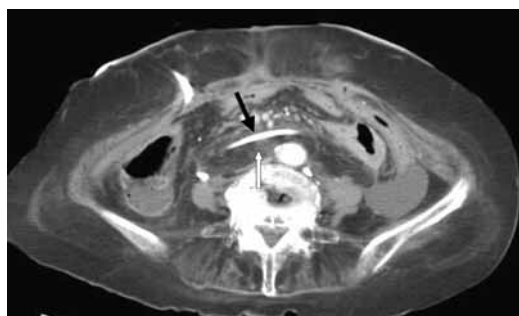


Fig. 5 Omental cushion method. The ureter (black arrow) is separated from the aorta by the fat layer of the omentum (white arrow).

catheter or hemostatic coils, to stem induced bleeding. Since urinary tract infection is inevitable in these patients, delay in diagnosis results in severe local sepsis and rebleeding. Therefore, postoperative active hemorrhage from the ureter should be regarded as due to ureteroarterial fistula until proven otherwise, and immediate intervention should be undertaken. Preoperative manipulation of a ureteral stent may result in catastrophic bleeding.^{3,6)} In such a case, intraureteral placement of hemostatic coils may temporarily halt the bleeding and buy time for definitive treatment.

Surgical treatment consists of ligation of the artery and resection of the ureter, followed by debridement and omental coverage. Arterial embolization alone has been reported to result in rebleeding.^{6,7)} Renal function should be preserved by nephrostomy, or nephrectomy should be performed if the contralateral kidney is functional. In a few lucky cases where infection of the arterial wall is minimal, direct suture closure of the arterial perforation can be performed.

Prevention of this condition is far more important than treatment but there has been no report on preventive measures. A fistula can result from pressure necrosis of the ureter if it is compressed between the ureteral catheter and a pulsating artery.⁸⁾ Since 2000, we have made it routine not to use a ureteral catheter even if this threatens unilateral renal function. Otherwise, we place the greater omentum between the ureter and aorta or iliac artery, and named this contrivance the omental cushion method (**Fig. 5**). Since introduction of this principle, we performed 9 cutaneous ureterostomies and

12 ileal conduits during a 2-year period, and have encountered no cases of ureteroarterial fistula but further observation is necessary.

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