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Postoperative outcomes after continent versus incontinent urinary diversion at the time of pelvic exenteration for gynecologic malignancies

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Abstract

Objective—To compare outcomes of patients undergoing continent or incontinent urinary diversion after pelvic exenteration for gynecologic malignancies.

Methods—Data on patients who underwent pelvic exenteration for gynecologic malignancies at The University of Texas MD Anderson Cancer Center between January 1993 and December 2010 were collected. A multivariate logistic regression model was used and statistical significance was $P < 0.05$.

Results—A total of 133 patients were included in this study. The mean age at exenteration was 47.6 (range, 30–73) years in the continent urinary diversion group and 57.2 (range, 27–86) years in the incontinent urinary diversion group ($P < 0.0001$). Forty-six patients (34.6%) had continent urinary diversion, and 87 patients (65.4%) had incontinent urinary diversion. The rates of postoperative complications in patients with continent and incontinent urinary diversion, respectively, were as follows: pyelonephritis, 32.6% versus 37.9% ($P = 0.58$); urinary stone formation, 34.8% versus 2.3% ($P < 0.001$); renal insufficiency, 4.4% versus 14.9% ($P = 0.09$); urostomy stricture, 13.0% versus 1.2% ($P = 0.007$); ureteral (anastomotic) leak, 4.4% versus 6.9% ($P = 0.71$); ureteral (anastomotic) stricture, 13.0% versus 23% ($P = 0.25$); fistula formation, 21.7% versus 19.5% ($P = 0.82$); and reoperation because of complications of urinary diversion, 6.5% versus 2.3% ($P = 0.34$). Among patients with continent urinary diversion, the incidence of incontinence was 28.3%, and 15.2% had difficulty with self-catheterization.

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Conclusion—There were no differences in postoperative complications between patients with continent and incontinent conduits except that stone formation was more common in patients with continent conduits.

INTRODUCTION

In patients with gynecologic malignancies, pelvic exenteration is an option for treatment of recurrent localized pelvic disease [1]. During a total or anterior pelvic exenteration, urinary diversion is routinely performed [2]. Patients can choose either continent or incontinent urinary diversion, and there are advantages and disadvantages associated with both of these techniques [3–11].

Incontinent urinary diversion was first described by Bricker in 1950 [3]. Bricker used ileum to form the urinary diversion; later, techniques involving use of non-irradiated transverse colon were also described [4,12]. Incontinent diversion is faster and less technically challenging than continent diversion; also, incontinent diversion may have the advantage of requiring less maintenance effort and self-care by the patient [9,12]. The incidences of early and late complications of incontinent urinary diversion have been reported to be 33% and 28%, respectively [13]. The most commonly reported complications are anastomotic leakage (3%), fistula formation (3%–19%), need for reoperation (8%–19%), renal insufficiency (6%–17%), urostomy stricture (7%), and ureteral obstruction (7%) [4,12,13]. The search for better surgical options with fewer complications led to the development of techniques for continent urinary diversion.

Continent urinary diversion has undergone many technical modifications since first described in 1982 by Koch et al. [5–8,14]. The Miami pouch, first described in recurrent gynecologic malignancies in 1988 by Penalver et al. [8], is the most commonly performed continent urinary diversion at The University of Texas MD Anderson Cancer Center. Continent urinary diversion offers better cosmetic results than incontinent diversion; however, overall complication rates with continent diversion remain significant and range from 37% to 66% [15,16]. The most common complications associated with continent urinary diversion are pyelonephritis (13%–42%), difficulty with catheterization (12%–54%), ureteral (anastomotic) stricture (2%–22%), urostomy stricture (4%–22%), incontinence (7%–13.3%), urinary stone formation (7%–18%), ureteral (anastomotic) leaks (2%–14%), fistula (2%–15%), and permanent renal failure (3%) [15–22]. There is also the potential risk of development of hyperchloremic metabolic acidosis [23].

There are only 3 studies in the gynecologic oncology literature to date that compare complications between the continent and incontinent urinary diversion techniques [16,19,22]. Limitations of these studies include short follow-up time, limited comparison of demographic characteristics, small number of postoperative complications analyzed, and the fact that these studies were not specifically designed to examine postoperative complications. The goal of this study was to compare postoperative outcomes of patients undergoing continent and incontinent urinary diversion at the time of pelvic exenteration for gynecologic malignancies. Our aim was to specifically evaluate complications related to the urinary diversion.

MATERIALS AND METHODS

Information about patients who underwent pelvic exenteration for gynecologic malignancies at The University of Texas MD Anderson Cancer Center between January 1993 and December 2010 was obtained from the institutional electronic database. The inclusion criteria included a diagnosis of gynecologic cancer, pelvic exenteration performed at MD Anderson Cancer Center, and urinary diversion performed at the time of pelvic exenteration.

The exclusion criteria included posterior pelvic exenteration, urinary diversion not performed at the time of exenteration, follow-up time less than 30 days, and follow-up information not available.

The type of urinary diversion was classified as continent or incontinent. All records were reviewed for site of primary gynecologic tumor, histologic subtype, age, body mass index, medical comorbidities, smoking status, estimated blood loss, difficulty with catheterization, incontinence, urostomy stricture, ureteral (anastomotic) leakage, ureteral (anastomotic) stricture, renal insufficiency, pyelonephritis, fistula formation, urinary stones, number of post-procedure hospitalizations due to complications of the urinary diversion, and number of reoperations as a result of complications of urinary diversion.

Medical comorbidities were defined as hypertension, diabetes, history of cancer (another primary tumor), chronic obstructive pulmonary disease, coronary artery disease, congestive heart failure, thromboembolic disease, chronic liver disease, and chronic kidney disease. Postoperative complications were classified as first occurring before or after the 60th postoperative day. Urinary stones were defined as stones in the urinary diversion on imaging studies. Renal insufficiency was defined as an increase in serum creatinine level to at least 150% of the baseline level or a baseline serum creatinine level of 1.8 mg/dL after the operation. Pyelonephritis, difficulty with catheterization, incontinence, and urostomy stricture were determined on the basis of documentation in the electronic medical record. Incontinence was defined as occasional or continuous leaking or overflow incontinence. Ureteral (anastomotic) leak and stricture were based on imaging studies.

Univariate tests of association to compare between continent and incontinent groups were conducted using Fisher's exact tests, 2-sample *t*-tests, or Kruskal-Wallis tests depending on the variable's distribution. A logistic regression model was conducted to determine whether postoperative complications may have a possible association with the type of urinary diversion. In building this model, we included all variables that were associated with urinary diversion at $P < 0.10$ on the univariate analysis and then modified using backwards selection. Statistical significance for inclusion in the final multivariate model was defined as $P < 0.05$.

RESULTS

A total of 161 patients with pelvic exenteration were identified in the selected time period. Of these, 17 patients were excluded because they had only a posterior exenteration ($n = 16$), or because the urinary conduit procedure was performed as a separate procedure before pelvic exenteration ($n = 1$). Therefore, 144 patients met inclusion criteria; however, 11 patients were excluded because follow-up was less than 30 days. The remaining 133 patients were included in the study.

Patient Characteristics

Ninety-nine patients (74.4%) had a total pelvic exenteration, and 34 (25.6%) had an anterior pelvic exenteration (Table 1). Forty-six patients (34.6%) had continent urinary diversion, and 87 patients (65.4%) had incontinent urinary diversion. The most common primary tumor site was the cervix (79 patients; 59.4%). The most common histologic subtype was squamous cell carcinoma (79 patients; 59.4%). The mean age at exenteration was 47.6 (range, 30–73) years in the continent urinary diversion group and 57.2 (range, 27–86) years in the incontinent urinary diversion group ($P < 0.0001$). No significant difference was found between the 2 urinary diversion groups in primary cancer site ($P = 0.46$) or histologic subtype ($P = 0.98$). Mean body mass index was lower in patients with continent urinary diversion (26.9 vs. 29.6 kg/m², $P = 0.049$); however, this difference was no longer

significant in the reduced multivariate model. The proportion of patients who had pretreatment pelvic radiation was 91.3% in the continent diversion group (42/46) and 89.7% (78/87) in the incontinent diversion group ($P > 0.99$). In our study there was a statistically significant difference in the number of co-morbidities between the groups ($p = 0.033$). We found that the incontinent conduit group had a statistically significant higher number of comorbidities. (Table 1) The median estimated blood loss was 1,800 mL (range, 500–8,500) in the continent urinary diversion group, compared to 2,200 mL (range, 700–13,000) in the incontinent urinary diversion group ($P = 0.28$). Overall, two (2.9%) of 69 patients with incontinent urinary diversions and three (10%) of 30 patients with continent urinary diversions, had a low-rectal anastomosis. The choice of low-rectal anastomosis was related to the location of tumor and surgeon preference.

Postoperative Complications

Median follow up-time after exenteration was 28.5 months (range, 2.3–185.7) for patients with continent urinary diversion and 28.1 months (range, 1.4–187.1) for patients with incontinent urinary diversion. The most common postoperative complication was pyelonephritis or urosepsis, which occurred in 32.6% (15/46) of the patients with continent urinary diversion and 37.9% (33/87) of the patients with incontinent urinary diversion ($P = 0.58$).

The second most common complication was urinary stone formation, which occurred in 34.8% (16/46) of the patients with continent urinary diversion and 2.3% (2/87) of the patients with incontinent urinary diversion ($P = 0.001$). No stone formation was observed in the first 60 days after continent urinary diversion. Of the 16 patients with stone formation and continent urinary diversion, 11 were asymptomatic and did not require intervention. Three patients underwent laparotomy for stone removal, 1 because of an enterocutaneous (pouch to skin) fistula, possibly secondary to infection and an obstructive mucous plug, and the other 2 because of large size ($n=1$) and number of stones ($n=1$). One patient had bilateral nephrostomy tubes placed because of urinary obstruction and poor functional status, and 1 patient was treated successfully with cystolitholapaxy. Both patients with stone formation and incontinent urinary diversion were asymptomatic and did not require intervention.

No significant differences were observed between the continent and incontinent urinary diversion groups for rates of ureteral (anastomotic) leakage, ureteral (anastomotic) stricture, renal insufficiency, fistula formation, conduit reoperation, or pyelonephritis or urosepsis (Table 2). No statistical significance in urostomy stricture formation was found after multivariate analysis ($p = 0.08$, Table 3). Among patients with at least one episode of pyelonephritis or urosepsis, there was no significant difference between the groups ($P = 0.20$). There was also no significant difference between the groups for the number of hospitalizations required because of complications related to the urinary diversion ($P = 0.45$).

When the analysis was limited to patients who had preoperative pelvic radiation (Table 4), there was an increased incidence of urostomy stricture after 60 days in patients with continent urinary diversion on univariate analysis. Of the patients with continent urinary diversion, 28.3% (13/46) reported incontinence, and 15.2% (7/46) reported difficulty with catheterization (Table 2).

DISCUSSION

In our study, the only postoperative complication with an incidence that differed significantly between continent and incontinent urinary diversion was stone formation after postoperative day 60, which was more common among patients with continent urinary

diversion (34.8% vs. 1.1%). In a previous study from our own institution, Ramirez et al. [17] reviewed postoperative complications in 40 patients with gynecologic malignancies and continent urinary diversion from 1988 to 2001 and reported that stone formation occurred in 18% of the patients. The difference in the rate of stone formation between the 2 studies might be attributed to a higher number of patients and a longer follow-up time in the current study.

In their previously published report, Ramirez et al. suggested that use of automatic staplers may be associated with an increased risk of stone formation [17]. In our study, both continent and incontinent urinary diversion were performed using automatic staplers only. Interestingly, in 2 patients in our study with continent urinary diversion, the stones were documented to be adherent to the staple line. One difference between continent and incontinent urinary diversion is that in order to maintain a low-pressure system for the continent urinary diversion, a larger urinary diversion is made, which requires more staples. Moreover, patients with a continent urinary diversion have increased urinary excretion of calcium, phosphate, magnesium, and mucus; all considered risk factors for stone formation [24–26].

We found 3 previously published studies comparing postoperative complications of continent and incontinent urinary diversion in patients with gynecologic cancers (16,19,22). In 2003, Houvenaeghel et al. [19] first reported complications of continent and incontinent urinary diversion. Their study included 124 patients, 14 (11.3%) with bilateral ureterostomies, 62 (50%) with incontinent diversion, and 48 (38.7%) with continent diversion. Patients were followed up for postoperative complications for only 12 weeks, and complications were classified as medical or surgical. Surgical complications were defined as urinary or digestive fistula, hemorrhage, abscess, and large vessel thrombosis. Complications were analyzed only in the continent and incontinent urinary diversion groups overall; no analyses by demographic characteristics was reported. The rate of post-operative surgical complications was 6.25% (3/48) in the continent urinary diversion group and 12.9% (8/62) in the incontinent urinary diversion group, and these rates were not significantly different. In preoperatively irradiated patients, however, there was a significantly lower surgical complication rate in patients with continent urinary diversion than in those with incontinent urinary diversion (2 of 42 [4.8%] vs. 8 of 39 [20.5%]; $P = 0.031$). The study is limited by the small number of complications evaluated, short follow-up period, and lack of demographic comparison.

In 2004, Karsenty et al. [16] reported on the complication rate of 56 patients who underwent pelvic exenteration, 17 (30.4%) with incontinent urinary diversion and 39 (69.6%) with continent urinary diversion. The median follow-up period for all patients was 19 months. The rates of late complications (after 90 days) for the continent and incontinent urinary diversion groups, respectively, were as follows: uretero-renal dilatation, 21% (8/39) versus 24% (4/17); urinary diversion reoperation, 12.8% (5/39) versus 18% (3/17); and late major urinary morbidity, 33% (13/39) versus 41% (7/17). Late major urinary morbidity was defined to include uretero-renal dilation, rise in creatinine, re-operation, pouch related complications, and anastomotic strictures. In the patients with continent urinary diversion, the rate of incontinence was 10% (4/39), and the rate of difficulty with catheterization was 10% (4/39).

In 2005, Goldberg et al. [22] published on a cohort of 103 patients who underwent pelvic exenteration with continent (38 of 103; 37%) or incontinent (65 of 103; 63%) urinary diversion. Most complication rates were calculated for the overall patient groups (all patients in study and all patients with continent diversions) and were not compared by type of urinary conduit. Rates were as follows: pyelonephritis, 36% (37/103); wound complication,

17% (17/103); difficulty with catheterization, 16% (6/38); ureteral (anastomotic) leaks, 14% (14/103), incontinence, 11% (4/38); small bowel obstruction, 9% (9/103); ureteral (anastomotic) stricture, 5% (5/103); urostomy stricture, 4% (4/103); urinary stones, 2% (2/103); and pouch fistula, 3% (1/38). The only statistical comparison by urinary type reported was for ureteral (anastomotic) leaks and ureteral (anastomotic) strictures. There was no significant difference in the rate of ureteral leaks between the continent and incontinent urinary diversion groups (5 of 38 [13%] vs 9 of 65 [14%]; $P = 0.92$). Ureteral stricture occurred in 7.9% (3/38) of patients with continent urinary diversion and 3.1% (2/65) of those with incontinent urinary diversion ($P = 0.4$). Interestingly, 54% (21/39) of the patients with continent urinary diversion reported that they would undoubtedly choose incontinent urinary diversion if they had the option again. Both patients who developed stones had continent urinary diversion, so 5.3% of the patients with continent urinary diversion and none of the patients with incontinent urinary diversion developed stones.

The finding by Houvenaeghel et al. [19] of a higher rate of surgical complications with incontinent versus continent urinary diversion in patients with pelvic radiation before surgery may potentially suggest that continent urinary diversion is a better choice for previously irradiated patients. In contrast, our subgroup analysis in patients with previous pelvic radiation revealed that the only significant difference in complications between the continent and incontinent urinary diversion groups was an increased rate of urostomy stricture among patients with continent urinary diversion on univariate analysis (11.9% vs 1.3%, $P = 0.007$, Table 4). Our data suggest that both types of urinary diversion are appropriate choices for patients with a history of radiation treatment.

When reviewing the urologic literature with regards to preferences on urinary diversion and quality of life associated with urinary diversion we noted several interesting findings. In 2007, a consensus conference convened by the World Health Organization (WHO) and the Societe Internationale d'Urologie (SIU) to review reports on urinary diversion. They found that published evidence did not support an advantage of one type of reconstruction over the others with regard to quality of life. A proposed reason for this was that patients are subjected preoperatively to method-to patient matching, and thus patients are prepared for disadvantages associated with different methods of urinary diversion. [27] Other studies in the urology literature have also confirmed that there is no convincing evidence that superior quality of life is achieved with a particular type of urinary diversion. [28, 29]

A study by Gore et al. [30] evaluated 3,611 patients who underwent urinary diversion after radical cystectomy. This study used the Surveillance, Epidemiology, and End Results (SEER) database. The authors found that only 20% of patients underwent continent urinary diversion and 80% were diverted with ileal conduit. In an analysis of long-term survivors (5 years or greater), Madersbacher and colleagues [31] evaluated complications related to ileal conduits. The authors found that the most frequent complications were related to kidney function/morphology (27%), stoma (32%), bowel (24%), symptomatic urinary infection (including pyelonephritis) (23%), conduit ureteral anastomosis (14%), and urolithiasis (9%). Interestingly, the rate of urolithiasis in patients followed longer than 15 years was 38%. This study demonstrated that the rate of conduit related complications is also high in the urologic patients. Another study by Wiesner et al. [32] evaluated over 800 patients who underwent continent urinary diversion in two urological tertiary referral centers. In that study, the authors found that stomal stenosis was seen in 23.5% of patients with appendix stoma and in 15.3% of those with intussuscepted ileal nipple. The incidence of calculi was 11% in reservoirs with intussuscepted ileal nipple and 5.6% in reservoirs with appendix stoma.

The strengths of our current study include a longer median follow-up time (28 months) than reported for other publications in the literature, the fact that the study was designed to

examine complications in patients undergoing urinary diversion, the multivariate analysis, and the large number of patients. Our study also examined the largest number of postoperative complications, and rates of individual complications were compared between the continent and incontinent urinary diversion groups. Weaknesses of our study include the fact that all data were from a single institution, the retrospective nature of the study, the long study period, and the lack of quality-of-life assessment. In our institution, we are currently conducting a prospective study evaluating quality-of-life in all patients undergoing pelvic exenteration.

In conclusion, our findings indicate that patients undergoing pelvic exenteration have a high risk of complications, and there is no difference in postoperative complication rates related to urinary diversion except that urinary stone formation is more common among patients with a continent urinary diversion. Continent urinary diversion is also associated with the potential for additional complications: incontinence and difficulty with catheterization. Our analysis contributes to understanding of the postoperative complications after continent and incontinent urinary diversion in patients undergoing pelvic exenteration for gynecologic cancers. Preoperative counseling is critical in helping the patient and surgeon decide which type of urinary diversion is the most appropriate choice.

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Highlights

Complications between continent and incontinent conduits are the same except for stone formation

The incidence of urinary incontinence in continent urinary diversion is 28.3%

Table 1

Patient characteristics by urinary diversion type.

Characteristics	Continent (n = 46)	Incontinent (n = 87)	Total	P Value
Age at exenteration, years				<0.001 ^a
Mean (SD)	47.6 (10.5)	57.2 (13.8)	53.9 (13.5)	
Median	48.4	59.0	54.1	
Minimum-maximum	30.4–72.7	27.1–85.9	27.1–85.9	
Body mass index, kg/m ²				0.049 ^a
Mean (SD)	26.9 (5.3)	29.6 (7.9)	28.7 (7.2)	
Median	26.4	28.9	27.8	
Minimum-maximum	19.2–42.6	15.1–50.9	15.1–50.9	
Type of exenteration, No. (%)				0.095
Anterior only	16 (34.8)	18 (20.7)	34 (25.6)	
Total	30 (65.2)	69 (79.3)	99 (74.4)	
Primary tumor site, No. (%)				0.456
Cervical	31 (67.4)	48 (55.2)	79 (59.4)	
Vaginal	9 (19.6)	17 (19.5)	26 (19.5)	
Vulvar	3 (6.5)	8 (9.2)	11 (8.3)	
Uterine	3 (6.5)	9 (10.3)	12 (9)	
Other	0 (0.0)	5 (5.7)	5 (3.8)	
Histologic subtype, No. (%)				0.983
Squamous	27 (58.7)	52 (59.8)	79 (59.4)	
Adenocarcinoma	15 (32.6)	26 (29.9)	41 (30.8)	
Mesenchymal	1 (2.2)	3 (3.4)	4 (3)	
Other	3 (6.5)	6 (6.9)	9 (6.8)	
Number of comorbidities, No. (%)				0.033 ^b
0	36 (78.3)	44 (50.6)	80 (60.2)	
1	6 (13.0)	26 (29.9)	32 (24.1)	
2	3 (6.5)	10 (11.5)	13 (9.8)	
3	1 (2.2)	6 (6.9)	7 (5.3)	
4	0 (0.0)	1 (1.1)	1 (0.8)	
Smoking, No. (%)				0.811
No	36 ^c (83.7)	69 ^d (81.2)	105 (82.0)	
Yes	7 (16.3)	16 (18.8)	23 (18.0)	
Radiation, No. (%)				>0.999
No	4 (8.7)	9 (10.3)	13 (9.8)	
Yes	42 (91.3)	78 (89.7)	120 (90.2)	
Estimated blood loss, mL				0.280 ^b
Mean (SD)	2401.1 (1613.1)	2812.4 (2200.4)	2670.1 (2019.9)	
Median	1800.0	2200.0	2000.0	
Minimum-maximum	500–8500	700–13000	500–13000	

^aTwo-sample *t*-test.

^bKruskal-Wallis test.

^cNo data available on 3 patients.

^dNo data available on 2 patients.

Table 2Postoperative complications by urinary diversion type.^a

Complication	Continent (n = 46)		Incontinent (n = 87)		Total	P Value
Urostomy stricture						0.007
None	40	87.0	86	98.9	126	94.7
Yes, < 60 d	1	2.2	0	0.0	1	0.8
Yes, > 60 d	5	10.9	1	1.1	6	4.5
Ureteral leakage						>0.999
None	44	95.7	81	93.1	125	94.0
Yes, < 60 d	2	4.3	5	5.7	7	5.3
Yes, > 60 d	0	0.0	1	1.1	1	0.8
Ureteral stricture						0.440
None	40	87.0	67	77.0	107	80.5
Yes, < 60 d	2	4.3	6	6.9	8	6.0
Yes, > 60 d	4	8.7	14	16.1	18	13.5
Renal insufficiency						0.105
None	44	95.7	74	85.1	118	88.7
Yes, < 60 d	1	2.2	2	2.3	3	2.3
Yes, > 60 d	1	2.2	11	12.6	12	9.0
Urinary stones						<0.001
None	30	65.2	85	97.7	115	86.5
Yes, < 60 d	0	0.0	1	1.1	1	0.8
Yes, > 60 d	16	34.8	1	1.1	17	12.8
Fistula formation						0.357
None	36	78.3	70	80.5	106	79.7
Yes, < 60 d	3	6.5	10	11.5	13	9.8
Yes, > 60 d	7	15.2	7	8.0	14	10.5
Reoperation						0.340
None	43	93.5	85	97.7	128	96.2
Yes, > 60 d	3	6.5	2	2.3	5	3.8
Pyelonephritis or urosepsis						0.687
None	31	67.4	54	62.1	85	63.9

Complication	Continent (n = 46)		Incontinent (n = 87)		Total	P Value
Yes, < 60 d	6	13.0	10	11.5	16	12.0
Yes, > 60 d	9	19.6	23	26.4	32	24.1
Wound Separation						0.089
None	32	69.6	46	52.9	78	58.6
Yes, < 60 d	14	30.4	37	42.5	51	38.3
Yes, > 60 d	0	0	4	4.6	4	3
Bowel Obstruction						0.016
None	35	76.1	66	75.9	101	75.9
Yes, < 60 d	0	0	10	11.5	10	7.5
Yes, > 60 d	11	23.9	11	12.6	22	16.5
Difficult catheterization						
None	39	84.8				
Yes, < 60 d	2	4.3				
Yes, > 60 d	5	10.9				
Incontinence						
None	33	71.7				
Yes, < 60 d	6	13.0				
Yes, > 60 d	7	15.2				
No. of episodes of pyelonephritis or urosepsis ^c						0.197 ^b
Mean (SD)	1.47 (1.06)		1.97 (1.69)		1.81 (1.53)	
Median	1		1		1	
Minimum-maximum	1-4		1-9		1-9	
Total number of patients			48/133 (36.1)			
No. of hospitalizations related to urinary diversion						0.448 ^b
Mean (SD)	0.8 (1.2)		1.4 (3.1)		1.2 (2.6)	
Median	0		1		0	
Minimum-maximum	0-6		0-25		0-25	

^aValues are expressed as number of patients (percentage) unless otherwise indicated.

^bKruskal-Wallis test.

^cIncludes only patients with at least 1 episode

Table 3
Multivariate logistic regression model for association with urinary diversion type.

	Full Model			Reduced Model		
	OR	95% CI	P Value	OR	95% CI	P Value
Age	1.06	1.02–1.10	0.004	1.06	1.03–1.10	0.001
Body mass index	1.07	0.99–1.15	0.081			
Number of comorbidities	1.22	0.61–2.40	0.576			
Type of exenteration	2.01	0.67–6.00	0.213			
Wound Separation < 60 d	0.63	0.21–1.88	0.409			
Bowel Obstruction > 60 d	0.69	0.21–2.25	0.541			
Urostomy stricture > 60 d	0.11	0.01–1.28	0.078			
Stones > 60 d	0.04	0.01–0.36	0.004	0.03	0.004–0.26	0.001

OR, odds ratio.

Table 4Postoperative complications in patients with a history of pelvic radiation by urinary diversion type.^a

Complication	Continent (n = 42)	Incontinent (n = 78)	Total	P Value
Urostomy stricture				0.007
None	36 (85.7)	77 (98.7)	113 (94.2)	
Yes, < 60 d	1 (2.4)	0 (0.0)	1 (0.8)	
Yes, > 60 d	5 (11.9)	1 (1.3)	6 (5.0)	
Ureteral leakage				>0.999
None	40 (95.2)	72 (92.3)	112 (93.3)	
Yes, < 60 d	2 (4.8)	5 (6.4)	7 (5.8)	
Yes, > 60 d	0 (0.0)	1 (1.3)	1 (0.8)	
Ureteral stricture				0.410
None	36 (85.7)	58 (74.4)	94 (78.3)	
Yes, < 60 d	2 (4.8)	6 (7.7)	8 (6.7)	
Yes, > 60 d	4 (9.5)	14 (17.9)	18 (15.0)	
Reoperation				0.611
None	40 (95.2)	76 (97.4)	116 (96.7)	
Yes, > 60 d	2 (4.8)	2 (2.6)	4 (3.3)	
Fistula formation				0.577