The Impact of Running versus Interrupted Anastomosis on Ureterointestinal Stricture Rate after Radical Cystectomy

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Purpose: Benign ureterointestinal anastomotic stricture is not uncommon after radical cystectomy and urinary diversion. We studied the impact of the running vs the interrupted technique on the ureterointestinal anastomotic stricture rate.

Materials and Methods: From July 2007 to December 2008 interrupted end-to-side anastomoses were created and from January 2009 to July 2010 running anastomoses were created. The primary study end point was time to ureterointestinal anastomotic stricture.

Results: Of 266 consecutive patients 258 were alive 30 days after radical cystectomy, including 149 and 109 with an interrupted and a running anastomosis, respectively. The groups did not differ in age, gender, body mass index, age adjusted Charlson comorbidity index, receipt of chemotherapy or radiation, blood loss, operative time, diversion type or postoperative pathological findings. The stricture rate per ureter was 8.5% (25 of 293) and 12.7% (27 of 213) in the interrupted and running groups, respectively ($p = 0.14$). Univariate analysis suggested that postoperative urinary tract infection (HR 2.1, 95% CI 1.1–4.1, $p = 0.04$) and Clavien grade 3 or greater complications (HR 2.6, 95% CI 1.4–4.9, $p < 0.01$) were associated with ureterointestinal anastomotic stricture. On multivariate analysis postoperative urinary tract infection (HR 2.4, 95% CI 1.2–5.1, $p = 0.02$) and running technique (HR 1.9, 95% CI 1.0–3.7, $p = 0.05$) were associated with ureterointestinal anastomotic stricture. Median time to stricture and followup was 289 (IQR 120–352) and 351 days (IQR 132-719) in the running cohort vs 213 (IQR 123–417) and 497 days (IQR 174–1,289) in the interrupted cohort, respectively. Of the 52 strictures 33 (63%) developed within 1 year. Kaplan-Meier analysis controlling for differential followup showed a trend toward higher freedom from stricture for the interrupted ureterointestinal anastomosis ($p = 0.06$).

Conclusions: A running anastomosis and postoperative urinary tract infection may be associated with ureterointestinal anastomotic stricture. Larger series with multiple surgeons are needed to confirm these findings.

Key Words: urinary bladder; urinary diversion; anastomosis, surgical; cystectomy; postoperative complications

Abbreviations and Acronyms

IC = ileal conduit

ONB = orthotopic neobladder

RC = radical cystectomy

UCC = urothelial cell carcinoma

UIA = ureterointestinal anastomosis

UTI = urinary tract infection

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RADICAL cystectomy with urinary diversion remains the gold standard therapy for muscle invasive bladder UCC with a reported 90-day overall complication rate of greater than 60%.[1] Benign UIA strictures have a post-RC incidence of 1% to 13%.[2–6] The etiology of benign UIA stricture is hypothesized to be ischemic or inflammatory. Intraoperative approaches to preserve ureteral in-

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tegrity include minimizing tissue handling, excising distal or compromised ureter before anastomosis, avoiding electrocautery near the ureteral blood supply and preserving periureteral tissue.

The technique of anastomosis was also studied as a possible risk factor for subsequent UIA. Studer,[2] Hautmann[3] and Pantuck[7] et al noted an increased risk of UIA stricture after using an antirefluxing technique. The Bricker end-to-side anastomosis may be performed in interrupted or running fashion. While previous urological oncologists and reconstructive surgeons stated that interrupted sutures are preferable to continuous sutures,[5] to our knowledge this has never formally been studied.

We identified whether a running vs an interrupted Bricker end-to-side technique would affect the rate of UIA stricture after RC.

MATERIALS AND METHODS

Institutional review board approval was obtained. In compliance with Health Insurance Portability and Accountability Act guidelines we reviewed a prospective database for patients treated for UCC with RC with IC or ONB urinary diversion by a single surgeon (GDS) at an academic hospital from July 2007 to July 2010. All diversions were performed in open fashion and all except 2 cystectomies were open. From July 2007 to December 2008 an interrupted Bricker end-to-side UIA was created in 149 patients and from January 2009 to July 2010 a running Bricker end-to-side UIA was created in 109 undergoing RC-IC and RC-ONB. The change in technique was planned with interim analysis scheduled after 1-year followup in the latter cohort. Thus, the current study is a sequential case series of the effect of a change in the UIA technique on ureteral stricture.

Each anastomosis was performed with 4-zero polyglactin suture on CV-23 needles. The running anastomosis was done using 2 sutures, each tied posterior at the 6 o'clock position and then run in opposite directions, such that a square knot could be tied between the 2 sutures at the 12 o'clock position to complete the anastomosis. All anastomoses were tested for watertightness upon completion and stented with a 5Fr feeding tube, which was removed after the patient tolerated an oral diet.

Our primary study end points were UIA stricture and time to UIA stricture. All strictures were identified based on an antegrade study and/or mercaptoacetyltriglycine renal scintigraphy. Secondary end points included urinary leak, percutaneous nephrostomy tube drainage, days to a regular diet and hospital stay. Patient age, gender, diversion type, clinical and pathological stage, preoperative and postoperative radiation or chemotherapy, operative time, estimated blood loss and hospital stay were studied. Complications were graded according to the Clavien classification system.[8] As necessary, the online Social Security Death Index was used to obtain the date of death.

We excluded from analysis 5 patients in the interrupted and 3 in the running anastomosis cohort who died within 30 days of surgery. We also excluded patients treated with nonileal diversion, including an Indiana pouch (37) and a colon conduit (2), since in these patients the anastomotic technique continued to be done with an interrupted technique. Four patients with a nonUCC indication for RC and 14 in whom RC and diversion were performed by another surgeon were also excluded from analysis.

Statistical analysis was done using Stata® 12. Means were compared using the Student t test and medians were compared using the Mann-Whitney U test. The Fisher exact and chi-square tests were used to compare categorical variables. A multivariate Cox proportional hazards model was used for age, gender, tumor stage and variables at $p < 0.10$ on univariate analysis, including anastomosis type, postoperative UTI and a Clavien grade III or greater complication within 30 days of surgery. No stricture was diagnosed within 30 days of surgery. Kaplan-Meier survival analysis and the stratified log rank test were used to compare time to UIA stricture across groups with 2-sided $p < 0.05$ considered significant.

RESULTS

The study sample consisted of 266 patients. Eight patients died within 30 days of cystectomy, leaving 258 in the total study population, including 149 in the interrupted and 109 in the running anastomosis cohort. Mean age was 68.6 years (95% CI 66.8–70.3) in the interrupted cohort and 67.6 years (95% CI 65.2–69.9) in the running cohort ($p = 0.49$). The groups did not differ significantly in gender, body mass index, age adjusted Charlson comorbidity index, prior chemotherapy or radiation, or final pathological findings (table 1). Intraoperative measures also did not significantly differ. Mean estimated blood loss was 1,036 (95% CI 950–1,121) and 1,055 ml (95% CI 960–1,150), and mean operative time was 285.5 (95% CI 278.2–292.8) and 292.4 minutes (95% CI 282.4–302.5) in the interrupted and running cohorts ($p = 0.77$ and 0.27, respectively). There was an approximately 3:2 predominance of IC vs ONB in each cohort.

Median followup was 351 (IQR 132–719) and 497 days (IQR 174–1,289) in the running and interrupted cohorts, respectively ($p = 0.006$). The rate of 30-day Clavien grade III or greater complications was significantly higher in the running anastomosis cohort (29.4% vs 12.8%, $p = 0.001$, table 1). Pelvic fluid collections required drainage in 10 patients, of whom stricture developed in 2 in the running group and 1 in the interrupted group. UIA stricture developed in 25 of 293 ureters (8.5%) in the interrupted group vs 27 of 213 (12.7%) in the running group ($p = 0.14$), that is in 20 vs 23 patients. Of the 43 patients the UIA stricture was on the left side in 20, the right side in 15 and bilateral in 8. There was no significant difference in stricture side between the 2 cohorts ($p = 0.33$). Neither of the 2 patients who underwent robotic cystectomy had a stricture. Me-