Central Role of Boari Bladder Flap and Downward Nephropexy in Upper Ureteral Reconstruction

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Purpose: We defined the role of the Boari bladder flap procedure with or without downward nephropexy for proximal vs distal ureteral strictures.

Materials and Methods: We retrospectively reviewed the records of all patients who underwent open ureteral reconstruction for refractory ureteral strictures, as done by a single surgeon between 2007 and 2010. Patients were grouped by stricture site into group 1—proximal third of the ureter and group 2—distal two-thirds. Operative techniques and outcomes were reviewed.

Results: During the 30-month study period a total of 29 ureteral reconstruction procedures were performed on 27 patients. A Boari bladder flap was used in 10 of the 12 patients (83%) in group 1 and 10 of the 17 (59%) in group 2. Concomitant downward nephropexy was done more commonly in group 1 (58% vs 12%, $p = 0.014$). At a mean followup of 11.4 months there was no difference in the overall failure rate between groups 1 and 2 (17% vs 12%). Complications developed more frequently in group 1 (75% vs 35%, $p = 0.060$), hospital stay was longer (mean 8.0 vs 4.4 days, $p = 0.017$) and mean estimated blood loss was greater (447 vs 224 ml, $p = 0.008$).

Conclusions: The Boari bladder flap procedure is a reliable technique to reconstruct ureteral strictures regardless of site. Renal mobilization with downward nephropexy is a useful adjunctive maneuver for proximal strictures.

Key Words: ureter, kidney, ureteral stricture, reconstructive surgical procedures, replantation

Abbreviations and Acronyms

BBF = Boari bladder flap
DN = downward nephropexy
IU = ileal ureter
IVP = excretory urogram
RA = renal autotransplantation
UC = ureterocalicostomy
UPJ = ureteropelvic junction
UR = ureteral reimplantation

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Unlike distal ureteral obstruction, which can usually be reconstructed by straightforward UR with a psoas hitch, proximal ureteral reconstruction necessitates more advanced surgical maneuvers, such as BBF, transureteroureterostomy, IU or RA. Potential shortcomings of transureteroureterostomy, IU and RA include risk to the contralateral renal unit, intestinal complications and renal loss, respectively.[1–3]

BBF has been done for ureteral reconstruction for more than a century. However, a review of the existing BBF literature yields only small series and sparse data while the outcomes of extended bladder flaps for proximal reconstruction has not been elucidated or compared to those of distal ureteral reconstruction.[4–6]

We defined the role of BBF in ureteral reconstruction and compared the safety and efficacy of BBF for proximal vs distal ureteral strictures. We also report our experience with renal mobilization and DN as an adjunctive maneuver to promote successful ureteral reconstruction.

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MATERIALS AND METHODS

We retrospectively reviewed all ureteral reconstruction procedures performed by one of us (AFM) from July 2007 to January 2010. Patient demographics, stricture site and etiology, reconstructive technique, blood loss, hospital stay and postoperative complications were tabulated. Stricture site was determined by reviewing preoperative radiographic data on each patient, including IVP, antegrade nephrostogram and/or retrograde pyelogram. Patients were grouped based on stricture site into group 1—ureteral segment extending from the UPJ to the cephalad limit of the sacroiliac joint and group 2—ureter overlying the sacroiliac joint and extending to the ureterovesical junction. All patients had refractory strictures greater than 2 cm and, thus, they were not candidates for ureteroureterostomy or further endourological management, although most had undergone at least 1 previous attempt. Adequate function of the involved renal unit was confirmed preoperatively by nuclear renogram (20% or greater differential function) or IVP (adequate renal parenchymal thickness). Preoperative bladder capacity was evaluated by cystography or simple cystometrogram. No patient in this series had bladder outlet obstruction or neurogenic dysfunction requiring additional treatment.

Operative Technique

While most of our initial cases were performed via a lower midline incision, most subsequent cases were approached via a modified Gibson incision. The muscle splitting, extraperitoneal lower quadrant incision was extended into a lazy-S configuration cephalad/lateral to the tip of the 12th rib and distal/medial to the lower midline, as needed to expose the entire ureter. For proximal strictures the cephalolateral incision extension provided excellent kidney exposure for renal pelvic dissection and DN, as necessary.

After division and spatulation of the ureter proximal to the stricture, the bladder was completely mobilized from its superior and anterior peritoneal attachments, sparing the contralateral superior vesical pedicle when possible. It was then filled with 300 cc normal saline. A curvilinear flap based ipsilaterally was outlined along the anterior bladder wall, extending across the midline in spiral fashion as needed to achieve adequate length. The minimum width of the base of the flap was 4 cm, wider when necessary to maintain a 3:1 length-to-width ratio. The flap was incised and the bladder was hitched to the psoas minor tendon with 3, 2-zero polydioxanone sutures. The open flap was reflected toward the divided proximal ureteral stump and anastomosed in tubularized, refluxing end-to-end fashion with interrupted 4-zero polydioxanone sutures. A Double-J® ureteral stent was inserted. The flap was rolled anterior and closed with running 3-zero polyglactin suture.

A closed suction drain was placed in the dependent pelvis. The urethral catheter was removed in 2 weeks after voiding cystourethrogram revealed no urinary extravasation. The ureteral stent was removed 6 weeks postoperatively.

DN was performed as warranted to further decrease tension on the repair. This was done via an open incision in most cases but via a laparoscopic approach when possible. Gerota's space was entered laterally and the perinephric fat was divided until the lateral renal border was found. The kidney was circumferentially dissected free of its perinephric attachments in Gerota's fascia, dividing any prior nephrostomy tracts and sparing only the renal hilum. This maneuver released the kidney, allowing it to descend toward the pelvis and decreasing the kidney-to-bladder distance for subsequent BBF. The kidney was anchored to the psoas hitch and/or directly to the mobilized BBF perivesical tissue.

Analysis

Followup evaluations were done by one of us (AFM). Patients were specifically queried on voiding patterns and flank/abdominal discomfort. Preoperative and postoperative serum creatinine, and imaging were reviewed. Postoperative imaging typically consisted of IVP or furosemide renal scan done within 1 month after stent removal and then as needed to evaluate symptoms suggesting recurrent obstruction. Failure was defined as the need for any postoperative procedures for persistent/recurrent obstruction.

Demographic and perioperative data on groups 1 and 2 were compared using the Fisher exact, Mann-Whitney and independent sample t tests for categorical variables, normally distributed continuous variables and nonnormally distributed continuous variables, respectively, with significance considered at $p \leq 0.05$. All reported p values are 2-sided. Analysis was done with SPSS®, version 17.0. This study was approved by the University of Texas Southwestern Medical Center institutional review board.

RESULTS

During the 30-month study period a total of 29 open ureteral reconstruction procedures were performed in 27 patients, including 12 for proximal third strictures (group 1) and 17 for distal two-thirds strictures (group 2). Bowel segments were not used for any ureteral reconstruction during this period. Groups 1 and 2 were similar in age, gender, stricture laterality, preoperative renal function and stricture etiology (see table 1).

Surgical Techniques

BBF was the most common reconstructive technique in groups 1 and 2 (83% vs 59%, $p = 0.23$). In the remaining 17% of group 1 patients, strictures were limited to the most proximal ureter and managed by DN and UC. UR with or without a psoas hitch was done in the remaining 41% of group 2 patients. DN was performed in most group 1 patients, a significantly greater frequency than in group 2 (58% vs 12%, $p = 0.014$). DN was done laparoscopically to assist lower ureteral reconstruction in 2 reoperative cases with extensive fibrosis.

Outcomes

The table lists perioperative outcomes in groups 1 and 2. Group 1 patients had more blood loss, a longer hospital stay and increased overall complications (75% vs 35%, $p = 0.060$). However, the fre-