
Preoperative placement of ureteral catheters has been recommended for prevention of ureteral injuries. During a three-year period, prophylactic ureteral catheters were inserted selectively in 59 patients undergoing colorectal surgery in whom a difficult dissection was anticipated. Three patients developed reflux anuria after the use of prophylactic ureteral catheters. The safety of these catheters is questioned, and the diagnoses and methods of preventing ureteral injuries are discussed. [Key words: Ureter; Ureteral catheters; Reflux anuria; Colorectal surgery]

IATROGENIC INJURY TO the ureter after colorectal surgery is an infrequent but serious event. The reported incidence of operative ureteral injury in surgery of the rectum and distal left colon approximates 1 to 10 percent. Just as unavoidable complications are inherent in all major surgery, the possibility of causing an avoidable injury to the patient must confront every surgeon. It is understandable that surgeons are reluctant to publish reports of complications about which they are personally responsible.

Preliminary cystoscopy and the introduction of ureteric catheters has been advocated as a way to identify and thus avoid the ureter during operation. Some surgeons recommend this practice, and others dispute its effectiveness. Preoperative ureteral catheterization is a necessary prelude to surgery in some cases, but frequently it is used as a safety measure by the inexperienced. Occasionally prophylactic ureteric catheters are associated with significant morbidity. Operative damage to the urinary system and introduction of infection are well-known complications. Transient or intermittent anuria has been reported occasionally.

During the three years between June 1985 and June 1988, 3 of 59 patients who had prophylactic ureteral catheters during colorectal surgery developed reflux anuria. Repeat cystoscopy in all three patients revealed the cause of urinary suppression to be obstructive edema of bladder mucosa. Repeat ureteral catheterization resulted in profuse flow of urine. Had the cause of the problem not been recognized, serious clinical consequences may have developed.

Report of Cases

Patient 1: A 51-year-old man, who had undergone abdominoperineal proctosigmoidectomy for mucinous C2 carcinoma and subsequent second stage pull-through anoplasty, presented with recurrent cancer of the rectum. Preoperatively, the excretory urogram...
showed prompt excretion bilaterally, a normal caliceal pattern, and no hemoglobin or myoglobin were detected in the urine. The ureteral catheters were allowed to remain in situ. The postoperative course was essentially unremarkable. The ureteral catheters were removed alternately over a period of 24 hours on days 7 and 8. At the time of discharge on day 10, the patient’s urine output and excretory urogram were normal.

**Patient 3:** A 79-year-old woman was found to have a large cecal carcinoma at colonoscopy. An abdominal CT scan suggested intraperitoneal spread. The patient had previously undergone a sigmoid colectomy for diverticular disease and an aortic valve replacement with Bjork-Shiley prosthesis.

An excretory urogram showed prompt excretion bilaterally, a normal caliceal pattern, and normal ureters in course and caliber. Preoperatively, size 5-F ureteral catheters were placed bilaterally. Cystoscopy showed marked cystocele and rectocele, and the bladder interior was trabeculated. Placement of the left ureteral catheter required manipulations with spiral tip catheter and guide wire. The operation included en bloc resection of a large cecal carcinoma with intraperitoneal spread. Hemodynamics were stable intraoperatively and urine output was satisfactory. Both ureteral catheters were removed in the recovery room, which resulted in immediate cessation of the urine output. There was no urine on bladder flushing, and anuria persisted despite aggressive fluid therapy. There was an acute rise in blood pressure to 210/110 mm Hg. The patient was transferred to the surgical intensive care unit where a Swan-Ganz catheter was placed for hemodynamic monitoring. The mean arterial pressure was 110 mm Hg, pulmonary capillary wedge pressure was 22 mm Hg, and the cardiac index was 3.2. The patient was returned to the operating room for visualization of upper urinary tracts and placement of ureteral catheters. Cystoscopy showed marked edema of both ureteral orifices with no efflux of urine. A ureteral catheter was inserted into the left ureter without difficulty, resulting in brisk and profuse flow of urine from the left kidney. Attempts to advance the right ureteral catheter to a more proximal position under fluoroscopic control were unsuccessful. Hydrodistention and retrograde flushes with 100 ml saline did not result in urine efflux. An excretory urogram of the right side showed an intact distal ureter and a nondilated collecting system and upper part of ureter. A left ureterogram showed multiple filling defects more likely consistent with blood clots. Real-time ultrasound showed the kidneys to be of normal size and configuration.

There was bilateral pelvicaliectasis, which was moderate in degree and symmetrical. Findings were compatible with hydronephrosis. A normal retrograde excretory urogram was obtained allowing prompt removal of both kidneys and marked delay in the excretory phase, suggesting obstruction. The left ureteric catheter was allowed to remain in situ. Over the next seven days, the patient remained oliguric with periods of intermittent anuria and with urine output of 200 to 900 ml every 24 hours. Deterioration in renal function was observed with progressive azotemia and hypertension. Urine microscopy showed few red cells and casts. On day eight, there was an acute drop in the urine output to 50 ml every 24 hours, at which time a nephrostomy was considered. An excretory urogram on day twelve showed good renal function bilaterally with a moderate degree of hydronephrosis. The left ureteral catheter was removed on day 13. Satisfactory diuresis continued after its removal. The patient was discharged in good condition on day 16.

**Discussion**

Severe oliguria or anuria is a rare but serious complication of ureteral catheterization. The term "reflux anuria," generally used to describe this phenomenon, implies that the suppression of urine flow is the result of neurogenic factors initiated by ureteral manipulation and mediated through the autonomic nervous system. Reflux anuria has been a controversial subject for many years. Ureteral catheterization has been shown to produce generalized cortical vasoconstrictive effect capable of producing oliguria and anuria. Hix found that unilateral ureteral stimulation caused a 20 percent reduction in ipsilateral renal blood flow and glomerular filtration rate. Shearlock and Howard11 reported on the first well-documented and evaluated case of reflux anuria. They concluded that the anuria was produced by a reflex spasm of the renal arterioles, which was confirmed by angiography. However, Sirota and Narins have clearly demonstrated that anuria after ureteral catheterization is due to edema, which causes mechanical obstruction at the ureterovesical junction.