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Noninvasive treatment of intraperitoneal urinary system perforations with percutaneous placement of a peritoneal drainage catheter

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Background/aim: : Intraperitoneal urinary system perforation is a rare but serious complication of endoscopic urologic surgery. Percutaneous placement of a peritoneal drainage catheter is already mainly used for diagnostic purposes. We present our experience with percutaneous drainage catheters for conservative management of intraperitoneal urinary system perforations occurring during endoscopic urologic surgery with close monitorization in selected cases.

Materials and methods: Urinary system perforations had developed in 21 (0.8%) of 2603 patients undergoing endoscopic urologic surgery at our department in 2014–2016. The perforation was intraperitoneal in only 5 (0.19) of all the patients. A percutaneous peritoneal drainage catheter with the guidance of ultrasonography was placed in four of the patients.

Results: Conservative management by draining excess fluid with a drainage catheter percutaneously placed under close monitorization was successful in four out of five patients with urinary system perforation occurring during endoscopic urologic surgery. The remaining patient was treated successfully with open laparotomy because of fulminant evidence of peritonitis.

Conclusion: Our findings and experience may suggest that conservative management of intraperitoneal urinary system perforations occurring during endoscopic urologic surgery by percutaneous drainage catheter under close monitorization is feasible in carefully selected patients.

Key words: Urinary system perforation, peritoneal drainage catheter, peritofix

1. Introduction

Intraperitoneal urinary system perforation occurring during urological surgery is a rare but serious complication. If not treated immediately, it can lead to significant complications such as peritonitis, uremia, acidosis, hypervolemia due to fluid resorption, and tumor seeding (1,2). The bladder is the urological organ most often subject to iatrogenic injury. Traditional management has been laparotomy with drainage of intraperitoneal fluid, repair, and/or reconstruction of the injury. By the exclusion of bowel injury, conservative therapy with the placement of percutaneous drainage catheters into the intraperitoneal and extraroperitoneal spaces is a suggested new mode of treatment (3). Moreover, some researchers suggest percutaneous drainage of the abdomen in an early postoperative period (1,4,5). Here we present our experiences with the conservative treatment of intraperitoneal urinary system injuries occurring during endoscopic urological surgery in our department.

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2. Materials and methods

We evaluated and analyzed the frequency and treatment modalities of intraperitoneal urinary system perforations occurring during endoscopic urological surgery retrospectively. From 2 June 2014 to 29 May 2016, a total of 2603 endoscopic urological surgeries were performed in our department. During this period, urinary system perforation was observed in 21 (0.8%) patients. The perforations were extraperitoneal in sixteen (76%) and intraperitoneal in five of our patients (24%). Five patients with the diagnosis of intraperitoneal perforation of the urinary system occurring during endoscopic urologic surgery were included study. In a patient with immediate diagnosis of showing mild suspicion of peritonitis with intraperitoneal perforation, an immediate laparotomy with drainage of intraperitoneal fluid and reconstruction of the injury site was performed. The remaining four patients with intraperitoneal perforation were treated conservatively. A 9-F peritoneal drainage catheter (PDC)

with 10-F trocar (Figure 1; Peritofix, B Braun Melsungen AG, Melsungen, Germany) was percutaneously inserted after infiltration of the abdominal wall with 2% prilocaine for drainage of the intraperitoneal fluid. The Peritofix set consists of a scalpel, a Ch-10 puncture trocar, and a polyurethane Ch-9 catheter and is widely used for diagnostic peritoneal lavage. Ultrasonography (USG) guidance was used to protect abdominal organs from injury. The Table demonstrates the clinical features of the patients with intraperitoneal perforation of the urinary system treated conservatively. Clinical features of our patients with intraperitoneal perforation of the urinary system treated conservatively are discussed in light of the available current literature.

3. Results

3.1. Case 1

A 54-year-old male patient presented with gross hematuria. USG examination of the urinary system revealed a large mass completely filling the bladder. Transurethral resection of the bladder tumor was performed under general anesthesia. One hour after the completion of the operation, diffuse abdominal distension and minimal signs of peritonitis were observed. Therefore, abdominal USG was performed and a large amount of free intraperitoneal fluid was observed. A PDC was inserted percutaneously with USG guidance. Approximately 2000 mL of fluid was drained. After completion of the drainage of the fluid, the catheter was removed on postoperative day 4 and the urethral catheter was removed on postoperative day 10. With the confirmation of the histopathologic diagnosis as muscle-invasive urothelial carcinoma, the patient underwent radical cystectomy and an ileal loop urinary diversion operation.

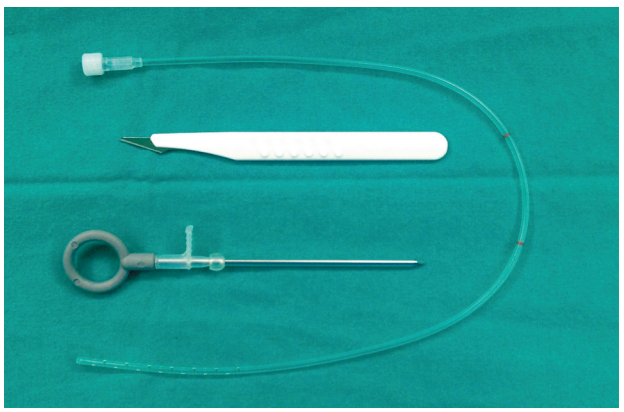

Figure 1. PeritofixHYPERLINK "http://www.esuppliersindia.com/b-barun-medical-india-pvt-ltd-/peritofix-catheter-set-for-diagnostic-peritoneal-lavage-pr3150794-sFP-swf.html"HYPERLINK "http://www.esuppliersindia.com/b-barun-medical-india-pvt-ltd-/peritofix-catheter-set-for-diagnostic-peritoneal-lavage-pr3150794-sFP-swf.html" catheter set for peritoneal lavage.

3.2. Case 2

Transurethral prostate incision and internal urethrotomy operations were performed for a 30-year-old male patient with a history of urinary tract tuberculosis. Urological examination with imaging studies revealed a right hydronephrosis and a low maximum urinary flow rate. There was no clinical evidence of active tuberculosis. Three consecutive urine samples were directly examined with respect to acid-resistant bacillus (ARB). Direct examination of urine samples found them to be negative for ARB. We planned diagnostic urethrocystoscopy under general anesthesia. During the procedure, multiple urethral strictures were observed and incised. Despite peroperative realization of the formation of a false urethral route, the bladder was entered and a pigtail catheter was placed to the right ureter. Diffuse abdominal distension was realized at the completion of the procedure. A USG scan of the abdomen confirmed the presence of significant intraperitoneal fluid. A PDC was inserted percutaneously with USG guidance, producing 1500 mL of fluid. The PDC was removed on postoperative day 3 and the urethral catheter was removed on postoperative day 25. The patient made an uneventful recovery at early postoperative period. The follow-up examination results were within normal ranges.

3.3. Case 3

A 31-year-old male patient had undergone ureterorenoscopy for treatment of a right distal ureteral stone at a community hospital. The patient was referred to our department on the first postoperative day upon realization of abdominal distension together with minimal signs of peritonitis. USG examination of the abdomen revealed the presence of free intraperitoneal fluid. Gadolinium-enhanced magnetic resonance imaging (MRI) showed right hydronephrosis and confirmed contrast extravasation at the middle and at the proximal portions of the right ureter together with intraperitoneal extension of contrast media with an appearance resembling cotton (Figure 2A). Ureterorenoscopy was performed and a pigtail catheter was placed successfully under direct vision as seen in Figure 2B. In the same session, a PDC was inserted percutaneously with USG guidance, producing 2300 mL of fluid. On the fifth postoperative day, drainage was stopped and the PDC was removed. The pigtail catheter was removed 1 month after the operation. He made a good recovery on follow-up examinations. He had no complaints and control magnetic resonance-urography examination was reportedly normal.

3.4. Case 4

A 64-year-old male patient who presented with lower urinary tract obstruction symptoms and a diagnosis of

Table. Characteristics of patients.

	Patient 1	Patient 2	Patient 3	Patient 4
Age (years)	54	30	31	64
Sex: female/male (F/M)	M	M	M	M
Diagnosis	Bladder cancer	Urethral stricture	Ureteral stone	BPH
Type of surgery	TUR-B	TUIP + internal urethrotomy	URS	TUR-P
Initial symptoms	Hematuria	Abdominal distension	Abdominal distension + peritonitis	Abdominal distension
Imaging findings	Diffuse intraperitoneal fluid on USG	Diffuse intraperitoneal fluid on USG	Diffuse intraperitoneal fluid + right hydronephrosis on USG	Diffuse intraperitoneal fluid at USG
Mode of therapy	PDC + urethral catheter	PDC + urethral catheter	PDC + urethral catheter + pigtail catheter	PDC + urethral catheter
Drained fluid volume at intervention day	2000 mL	1500 mL	2300 mL	2500 mL
Peritofix catheter removal day	4	3	5	4

TUR-B = Transurethral resection of the bladder tumor; TUIP = transurethral incision of the prostate; URS = ureterorenoscopy; TUR-P = transurethral resection of the prostate; PDC: peritoneal drainage catheter.

benign prostatic hyperplasia underwent transurethral resection of the prostate. During transurethral resection of the prostate, distention of the abdomen and diminished backflow of irrigation fluid were realized. USG examination confirmed the presence of significant intraperitoneal fluid. A PDC was inserted percutaneously with USG guidance, producing 2500 mL of fluid. The PDC was removed on postoperative day 4 and the urethral catheter was removed on postoperative day 10. The postoperative period was uneventful. On follow-up examinations, his bladder function was normal.

4. Discussion

Our findings confirm the suggestion that urinary system perforations occurring during endoscopic urologic surgery are significantly decreased. Intraperitoneal perforations of the urinary system occurring during endoscopic urologic surgery were identified in 0.19% of our patients. In three patients intraperitoneal perforations of urinary system were realized immediately. One other patient was referred to our department on the first postoperative day. In one patient, because of aggravated clinical conditions, urgent open laparotomy was preferred.

The incidence of iatrogenic ureteral trauma during endoscopic urologic surgery has decreased in the last 20 years due to improvements in technique, instruments, and surgical experience. Despite this, ureteral perforation reportedly occurs in 0.2%–2% of cases (6). Occult ureteral injury occurs more often than reported and not all injuries are diagnosed intraoperatively (7). Partial injuries can be repaired immediately with a stent or urine diversion by a nephrostomy tube. In the case of intraperitoneal fluid accumulation that causes minimal signs of peritonitis, such as in our third patient, percutaneous drainage with a PDC may be helpful. Moreover, our study is the first defining percutaneous intraperitoneal drainage with a PDC for ureteral traumas in the available literature.

The bladder is the urological organ that most often suffers iatrogenic injury (8). External iatrogenic bladder trauma occurs during open surgery. Internal bladder trauma mainly occurs during transurethral resections of bladder tumors.

Intraperitoneal iatrogenic bladder trauma is suggested by cystoscopic identification of fatty tissue, a dark space between detrusor muscle fibers, or the visualization of the bowel. Signs of major perforation are the inability to distend the bladder, a low return of fluid, and abdominal distension. Clinical signs and symptoms include hematuria, abdominal pain, abdominal distension, ileus, peritonitis, sepsis, decreased urinary output, and increased serum creatinine. Extraperitoneal perforations are reportedly more frequent than intraperitoneal perforations in internal trauma, at 0.57% and 0.16%, respectively, and rarely require intervention (9,10). In the case of extraperitoneal perforation, conservative management with urethral drainage may usually be adequate.

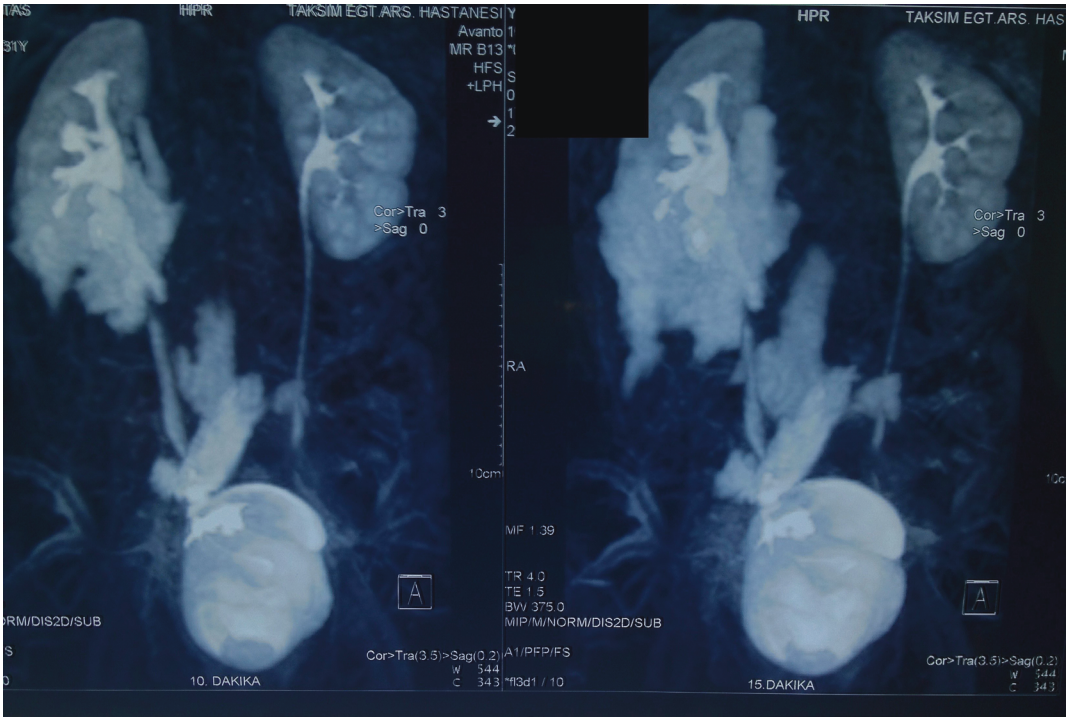

Figure 2A. Gadolinium-enhanced MRI examination showing right hydronephrosis and contrast extravasation at the middle and proximal portions of the right ureter together with intraperitoneal extension of contrast media resembling cotton in appearance.

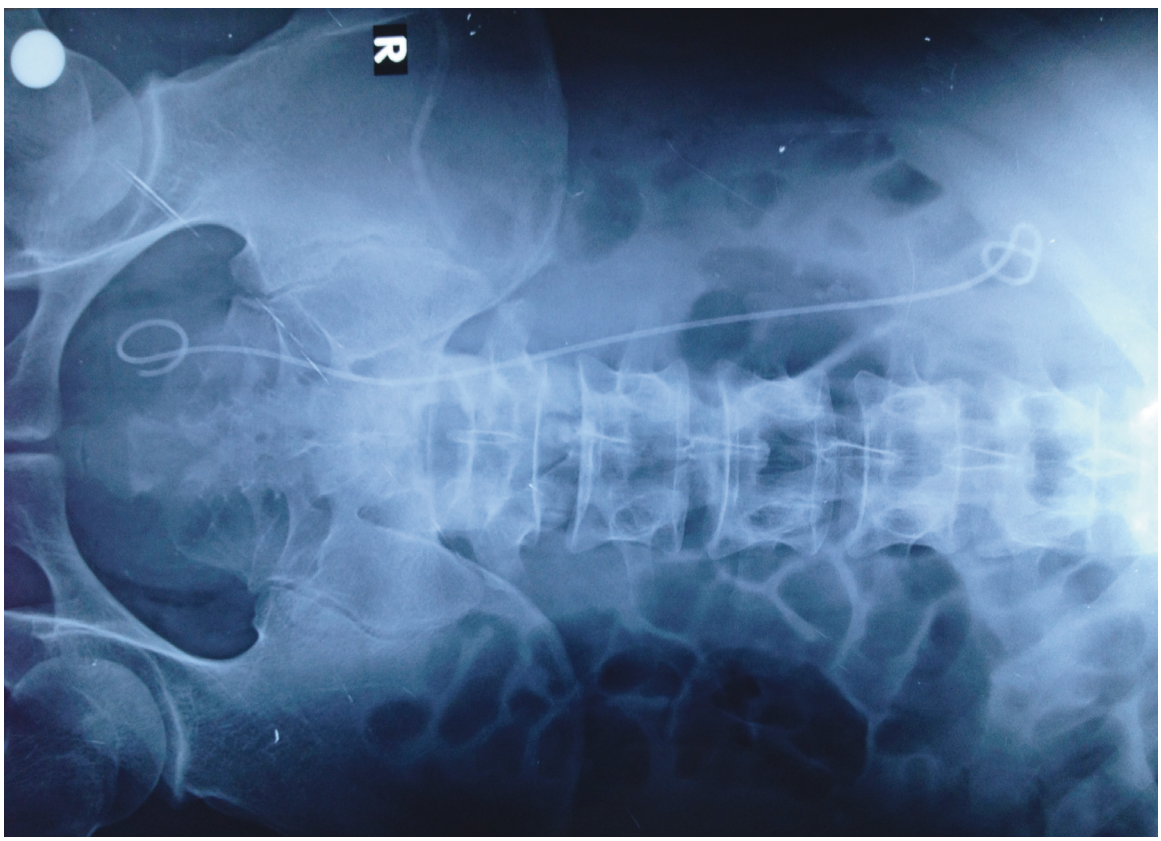

Figure 2B. Abdominal X-ray showing successfully inserted double-J stent of the same patient.

Intraperitoneal perforation is a more serious complication that may cause peritonitis, sepsis, and death (11). The traditional management has been laparotomy with drainage of intraperitoneal fluid, repair of the injury, exclusion of bowel injury, and placement of drainage catheters into the intraperitoneal and extraperitoneal spaces (12,13). In the absence of other intraabdominal injuries, laparoscopic suturing of the intraperitoneal rupture may be adequate (14). On the other hand, there is a risk of tumor seeding due to perforation, but the current literature contains conflicting information about tumor seeding due to bladder perforation (1,15). In the literature, all the recurrence cases are perforation cases that are reoperated with open surgery. There were no reports of extravesical recurrence treated conservatively (10).

The rare association of bowel injury with intraperitoneal urogenital perforations may have catastrophic results. In the case of suspected bowel injury, immediate laparotomy should certainly be the preferred treatment of choice. The advantages of percutaneous drainage with a PDC are that it avoids further anesthesia, especially in patients diagnosed late after recovery from anesthesia, and it avoids the morbidity of laparotomy. All patients who have been treated with percutaneous drainage should be monitored closely. In the case of no cessation of or aggravation of the signs of peritonitis despite the catheter, an immediate laparotomy is severely recommended. Percutaneous drainage with a PDC was found to be sufficient in four of our patients, and none required laparotomy at follow-up.

A PDC is easily inserted under local anesthesia with USG guidance into the abdomen. Percutaneous drainage and antibiotic prophylaxis may be as effective as laparotomy in uncomplicated intraperitoneal perforation without fulminant peritonitis and ileus (5,16). The applications of a pigtail catheter or Foley catheter for peritoneal drainage of intraperitoneal perforations have been described previously (4,5). To our knowledge, ours is the first study that defines PDC placement for intraperitoneal urogenital system perforations occurring during endoscopic urological surgery.

In conclusion, iatrogenic intraperitoneal urinary system perforations are not uncommon complications of endoscopic urologic surgeries. Although immediate laparotomy remains the standard mode of treatment for intraperitoneal perforations, our experience may suggest percutaneous placement of a PDC drainage as an alternative mode of therapy in selected patients. However, close monitorization of patients is obligatory, and in the case of persistence of the signs of peritonitis or in the case of suspicion of bowel injury, an urgent laparotomy is mandatory. Laparoscopic repair is another suggested technique with less morbidity, but there are no large series or long-term follow-ups. Here we have presented our modification of a diagnostic procedure already in use for the treatment of noncomplicated intraperitoneal urinary system perforations occurring during endoscopic urologic surgery. New studies with larger series are needed for evaluating the effectivity and safety of percutaneous drainage.

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