European Review for Medical and Pharmacological Sciences 2017; 21: 5330-5336

Treating ureteric obstruction secondary to gynecological disease assisted with retrograde ureteroscopic stenting

J.-C. CHEN[1], S.-X. ZHU[1], L.-G. REN[2], J. CHEN[2], W. ZHANG[2]

[1]Department of Urologic Oncology, Zhejiang Cancer Hospital, No. 1, Gongshu District, Hangzhou, China
[2]Department of Urologic Oncology, Tongde Hospital of Zhejiang Province, Xihu District, Hangzhou, China

Abstract. – OBJECTIVE: To analyze the technical experience and clinical efficacy of ureteroscopic treatment of middle and lower ureteral obstruction due to gynecological disease.

PATIENTS AND METHODS: From January 2007 to December 2015, 58 cases of ureteral obstruction were collected in 55 patients caused by gynecological factors. 19 cases had the history of gynecological iatrogenic injury and 39 cases were secondary to gynecological tumors. Different situations of luminal stenosis included obliteration, suture penetration, transection and unrecognized ureteral orifice. The ureteral stents were retrogradely placed ureteroscopically assisted by holmium laser or transurethral plasma kinetic resection.

RESULTS: A total of 51 cases of operations were completed successfully by one-stage ureteroscopic stenting with the mean operation time of 33.5 min. No severe complications were observed. The serum creatinine two weeks after operation had a significant decline compared with that of preoperation ($p<0.05$). The mean follow-up time was 5.3 months. 44 cases with successful stent placement showed nice improvement of hydronephrosis by ultrasound.

CONCLUSIONS: Ureteroscopic stent placement with the use of holmium laser or plasma kinetic resection device, has good clinical effects, which provides a relatively simple and minimal-invasive treatment option to resolve middle and lower ureteral obstruction caused by complex gynecological factors.

Key Words
Ureteroscope, Gynecological tumor, Iatrogenic injury, Ureteral obstruction.

Introduction

Ureteral obstruction involvement of the middle or lower ureter is a common clinical problem, which is often challenging to manage. Gynecological factor is one of the most common causes, including ureteral iatrogenic injury and gynecological tumors. Ureteral iatrogenic injury is a potential complication in gynecological surgery for tumors, which has increased in the past 20 years and is mostly caused by gynecologically laparoscopic surgery located in the lower segment of ureter[1]. At the same time, gynecological tumors tend to invade into pelvic cavity and lead to an infringement or oppression to ureter. The development of malignant ureteric obstruction is often an ominous sign, frequently translating into a survival time measured in months. Ureteral obstruction may lead to sepsis and loss of renal function. Furthermore, the adjuvant or palliative chemotherapy and radiotherapy are often needed for the gynecological tumors, but kidney dysfunction caused by ureteral obstruction may destroy this process. The goal for decompression may involve avoiding the complications of renal insufficiency, palliating symptoms of disease progression, and facilitating following treatments. A decision is usually made through a multi-disciplinary approach. To improve the patient's quality of life and possibly longevity, the next decision is how to achieve this obstructive effectively[2]. Patients with advanced cancer usually have lower performance status. Furthermore, the repetition of surgery and post-operational radiotherapy could lead to a sophistication to regular ureterostomy or ureter repair for patients with urinary fistula, significant fibrosis or adhesions in pelvis[3]. Ureteric stent replacement using a double-pigtail catheter is a well-established procedure in the palliative care of these patients; it has less trauma and is well tolerated. However, the success rate of regularly endoscopic retrograde stenting is relatively low[4]. Percutaneous nephrostomy (PCN) may be an alternative procedure for relieving the malignant

Corresponding Author: Wei Zhang, MD; e-mail: isupertony@126.com

urinary obstruction, but the patients may refuse the nephrostomy because of the complications and the low quality of life. Ureteroscope-assisted ureteral double-J stenting is a simple and safe alternative allowing intraluminal navigation along the entire ureter, correct stent placement; the reports of treating ureteric obstruction assisted with retrograde ureteroscopic stenting are quite rare.

We carried out ureteral catheterization assisted with ureteroscope by holmium laser or transurethral plasma kinetic resection on 51 ureteral units (UUs) with ureteric obstruction secondary to gynecological disease successfully. Therapeutic effects and experience of this operation were analyzed in this article.

Patients and Methods

Patients' Data

55 patients were treated in Zhejiang Cancer Hospital from January 2007 to December 2015, whose obstruction of ureters were located in lower or middle segment and caused by gynecological malignant disease or complications of gynecological operations. Patients were diagnosed as the obstruction located in lower or middle segment of the ureter and secondary hydronephrosis by preoperative examinations focus on urinary system, such as ultrasound, intravenous urography angiography, retrograde urography and computed tomography urography (CTU) or magnetic resonance urography (MRU) examination. The renal function was examined by radioisotope renogram. This clinical study was approved by Ethics Committee of Zhejiang Cancer Hospital.

Surgical Method

The prophylactic antibiotics were given to every patient at 30 min before operation. If the operation lasted longer than 3 h, the antibiotics needed to be repeated. The general anesthetic was carried out on all the patients. The patients were placed in the lithotomy position. The ureteroscopy was carried out to explore the obstructive ureter. Usually, the rigid ureteroscope with the inner of F6 or F8 was selected in operations (Karl Storz, Hamburg, Germany), depending on the degree of obstruction. A 0.038 inch guide-wire with a hydrophilic tip was used to assist catheterization (Cook, Bloomington, IN, USA). Double-J stent was inserted in obstructive ureter (Cook, Bloomington, IN, USA), which can be placed for half a year and should be replaced by ureteroscope or cystoscope.

During the process, some difficult circumstances had to be overcome, such as unidentified ureteric orifice, long lesions range, severe obstruction, sutured ureter and so on. For the UUs with unidentified ureteric orifice, the observation for trigonum vesicae and contralateral ureteric orifice can be assisted by plasma resectoscope (Olympus, Tokyo, Japan) (Figure 1A). Next, it was possible to find the diseased ureteric orifice at the symmetrical position along the inter-ureteric ridge, where electrosurgical incision was taken. It was very difficult to operate for patients with long lesions range and severe obstruction, because the guide wire was not able to pass through. In this situation, it was important to estimate the trend of ureter. The scope was rotated and went forward as a dilator following the guide wire (Figure 1B). For sutured ureter, holmium laser could cut the suture off and relief it from obstruction (Figure 1C), but surgeons should pay attention to the distance between ureter and fiber and frequency to avoid perforation. Especially, if patients had long lesions range or severe obstruction, the stent for tumor was recommended (Bard, Murray Hill, NJ, USA), which is permanent. We also used the data of ureteral catheterization assisted with cystoscope, which was undertaken in our Department and compared to the success rate of ureteral catheterization assisted with ureteroscope and cystoscope. Postoperatively, these patients received radiograph to ensure the locations of the stents and were closely monitored to check the patency of their stents with renal function tests and ultrasound scans to ensure that the hydronephrosis was stable or resolved. Antibiotics and hemostatic drugs could be used depending on the symptoms.

Statistical Analysis

The statistical analysis was performed using SPSS 19.0 (IBM, Armonk, NY, USA) for Windows. We used χ^2-tests to determine the significance of differences between proportions. The *t*-test was used to compare the serum creatinine levels before and after surgery. A p-value <0.05 was considered statistically significant.

Results

Patients' Characteristics

Because 3 patients had bilateral obstruction, 58 UUs were totally included. 19 UUs of them were caused by postoperative complication, while the rest was caused by gynecologic malignant tumors (Table I). The age of patients was ranged from

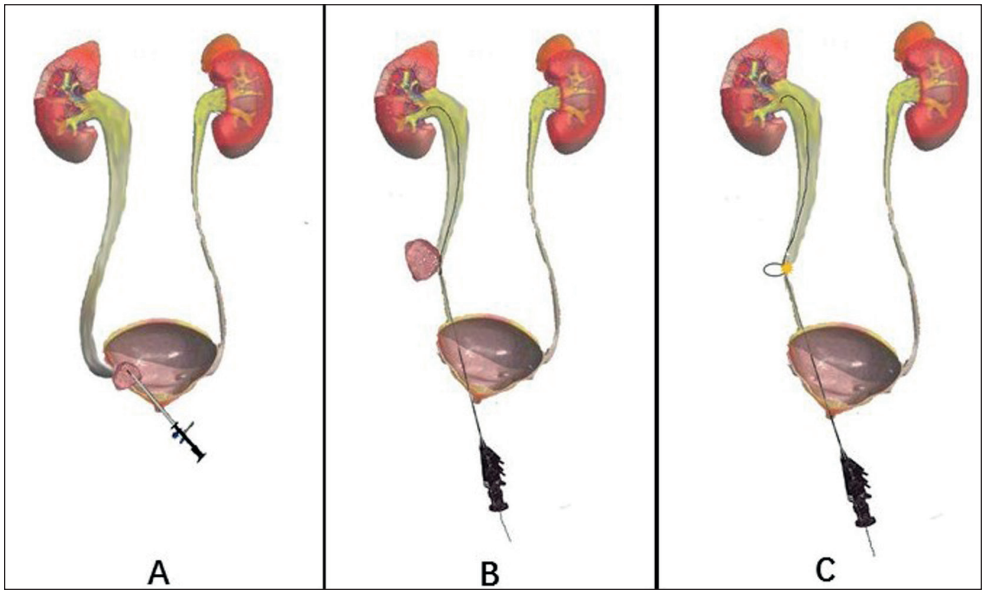

Figure 1. Surgical method of retrograde ureteroscopic stenting in some difficult circumstances. **A**, For the UUs with unidentified ureteric orifice, the observation for trigonum vesicae and contralateral ureteric orifice can be assisted by plasma resectoscope. **B**, For patients with long lesions range and severe obstruction, the scope was rotated and went forward as a dilator following the guide wire. **C**, For sutured ureter, holmium laser could cut the suture off and relief it from obstruct.

37 to 78 years (median 54.3 years). Additionally, 2 patients suffered with duplication anomalies of the ureter, congenital ureteropelvic junction (UPJ) stricture existed in 1 patient, and another patient had horseshoe kidney with ureteral high adhesion.

Treatment Process

A total of 51 UUs accepted ureteral catheterization without failure. 7 UUs failed in the operation and then percutaneous nephrostomy or ureterocystostomy was performed to the effective drainage. The overall success rate was 87.9%. The operation time was ranged from 10 to 90 min (median 33.5 min). The intra-operative blood loss was about 5 to 50 mL (median 20 mL). The time of postoperative urethral catheter was 1-3 days (median 2 days). 4 UUs had complications of ureteral perforation, but ultimately stent was placed successfully. No other serious complication appeared.

Outcome of Ureteral Catheterization

The success rate and complication for patients with different types of ureteral obstruction are shown in Table II. The success rate in the ureteral catheterization assisted with ureteroscope is significantly higher than cystoscope, especially in subgroups of moderate hydrops, tumor compression, iatrogenic injury and 1 month more length of history (Table III).

Table I. Success rate of catheter for the ureter obstruction located in lower and middle segment caused by various gynecologic diseases.

Obstruction cause		UUs n=58	Success (%)
Iatrogenic factors n=19	Radical hysterectomy	11	9 (81.8)
	Hysterectomy	5	4 (80.0)
	Laparoscopy for endometriosis	2	1 (50.0)
	Cesarean section	1	1 (100)
Gynecological tumor oppression n=39	Ovarian cancer	20	18 (90.0)
	Cervical cancer	12	11 (91.7)
	Endometrial cancer	4	4 (100)
	Fibroid	2	2 (100)
	Leiomyosarcoma of uterus	1	1 (100)

Table II. Stratified analysis for clinical features between ureteroscope and cystoscope.

Stratification	Method	Success	Failure	χ^2	*p*	Fisher's exact
Total	U	51	7			
	B	31	19	9.8781	0.002	0.003
History of pelvic radiotherapy	U	17	4			
	B	11	3	0.0298	0.863	1.000
Mild hydrops[2]	U	33	3			
	B	24	4	0.5729	0.449	0.689
Moderate hydrops	U	13	2			
	B	5	9	7.985	0.005	0.008
Severe hydrops	U	5	2			
	B	2	6	3.233	0.072	0.132
1 month more length of history	U	23	4			
	B	9	14	11.43	0.001	0.001
1 month less length of history	U	28	3			
	B	22	5	0.949	0.330	0.453
Tumor oppression	U	36	3			
	B	29	11	5.313	0.021	0.037
Iatrogenic injury	U	15	4			
	B	2	8	9.385	0.002	0.005

Method: U means that the surgery was assisted by ureteroscope, B means that the surgery was assisted by cystoscope; Mild hydrops: The degree of the hydrops was estimated according to the separation status of collection system by preoperative ultrasound: 2-3 cm was considered as mild hydrops, 3-4 cm was considered as moderate hydrops, more than 4 cm was considered as severe hydrops.

Postoperative KUB displaying double-J stent position was in place. The postoperative 24 h urine volume was 800 to 6500 mL (median 2582 mL). The most common adverse effect following the procedure was hematuria, which can be seen in most patients, but it can disappear in few days. The second most common side effects are the symptoms of urinary irritation, which can be seen in about 15% of the patients. These symptoms can be relieved by M-receptor blockers. About 5% of the patients suffered from fever after the procedure and recovered after using the antibiotics. Besides, patients who had backache accounted for about 10%. Next, the procedure patients took ultrasound to ensure that the hydronephrosis was stable or resolved. Though most patients might have more or less hydronephrosis, they had improvement after the procedure according to the ultrasound. Laboratory examination results showed preoperative serum

Table III. Success rate for operation grouped in cases of ureteral obstruction.

Type of ureteral obstruction[1]	UUs	Success	H	R	Stent	Perforation	Effectiveness[4]
Stenosis	3332	7	-	4	1	29/33	
Occlusion	107	8	-	7	2	5/10	
Suture penetration	44	4	-	-	0	3/4	
Transection	42	-	-	-	0	2/4	
Unrecognized Ureteral orifice	76	-	7	-	1	5/7	

Note: Type of ureteral obstruction: If the ureteral wall is continuous, the ureteral fistula belongs to into the luminal stenosis or occlusion group. If the ureteral is complete mutilation, it belongs to ureteral transection groups; H: Holmium laser; R: Transurethral plasma kinetic resection; Effectiveness: Secondary hydronephrosis is relieved through ultrasound examination at 2 months after operation.

creatinine (Cr) of 78.3-862.6 μmol/L (median 185.2 μmol/L) and urea nitrogen (BUN) of 4.7-42.5 mmol/L (median 13.7 mmol/L). Serum creatinine value of patients was 64.2 to 652.6 μmol/L (median 118.3 μmol/L) after 2 weeks, which had a significant decrease compared with the preoperative status ($p<0.05$).

Follow-up

The follow-up time was from 3 to 12 months (median 5.3 months). 5 cases dead for advanced cancer or lost to follow-up. It was found that 44 of 55 successful UUs relieved from the secondary hydronephrosis by ultrasound examination. 3 UUs were exacerbated, on account of ureteral stent blockage or tumor compression, and then got remission by the replacement of double-J stent or ureteral stent. The symptom of 44 UUs remains stable without the deterioration of renal function.

Discussion

The retrograde ureteral catheterization was the preferred treatment for the ureteral obstruction caused by gynecologic malignant diseases; there was a low success ratio in patients with ureteral extrinsic obstruction caused by malignant pelvic tumors, who received retrograde ureteral catheterization assisted with cystoscope. Danilovic et al[5] reported that the failure rate was 52% (13/25), and Chitale et al[6] reported that the success rate was only 21%. Otherwise, PCN could be used to relief the hydrops. Usually, it was applied to the patients with the unrecognizable ureteral orifice, obstruction close to ureteropelvic junction (UPJ) or as a surgery to make up for the failure of retrograde catheter[7,8]. However, it had some serious complications, such as bleeding, infection, intestinal perforation[9], whose occurrence rate was about 10%[10]. Other complications related with PCN, including the slippage of nephrostomy tube and exogenous infection, might occur after percutaneous nephrostomy[11]. The nephrostomy tube had a greater influence on the quality of life for patients[9]. Furthermore, its operation process was complex, especially for solitary kidneys and mild hydrops. Therefore, the issue of decompression of an obstructed urinary tract in a patient with advancing pelvic malignancy still remains a difficult clinical situation[12]. Because most urologists are familiar with ureteroscopic skills, we introduce a method to intraluminally place the stent easily through ureteric obstruction for patients with gynecological tumors, without malposition, radiation exposure or significant complications. Plasma resectoscope and holmium laser were used to deal with different situations, such as unidentified ureteric orifice, long lesions range, severe obstruction, and sutured ureter. Stent placement is often undertaken with the aid of cystoscopy prior to ureteroscopy, especially for patients with urinary calculus. However, the reports of ureteroscopic stenting were scarcely reported. However, this technology is a simple and safe alternative allowing intraluminal navigation along the entire ureter, correct stent placement without radiation exposure[13]. We showed that the success rate in the ureteral catheterization assisted with ureteroscope is significantly higher than cystoscope. Furthermore, our results also showed that there is statistical significance in subgroups of moderate hydrops, tumor compression, iatrogenic injury and 1 month more length of history, where the ureteroscope is superior to the cystoscope at retrograde catheterization. On the other hand, the difference does not appear in subgroup of mild or severe hydrops, history of radiation therapy and 1 month less length of history. It seems to be contradictory to the previous result. In fact, the fewer UUs can lead the paradoxical phenomenon. After the combination of moderate and severe hydrops subgroups, the result is consistent with previous finding. So the ureteroscope is a better choice for patients with moderate or severe hydrops. For oppressive obstruction, the ureter is continuous in spite of stenosis, the ureteroscope improves the success rate, which can assist the guide wire to pass through the ureteral stenosis compared to cystoscope. For iatrogenic injury, the continuity of ureter is damaged, which is more complicated to operate than the oppressive obstruction. Though the failure rate is still high regardless of surgical method, the operation assisted with ureteroscope becomes more successful than cystoscope. Otherwise, patients can get definite diagnosis and niche targeting treatment.

The history of pelvic radiotherapy and radiotherapy complications are common for patients diagnosed with gynecologic malignant tumors, such as radio-cystitis and secondary retroperitoneal fibrosis. It is more difficult for those patients to ureteral catheterization, because for them bladder hemorrhage and follicular hyperplasia in trigone are adverse to recognizing ureteral orifice. In our study, there was no statistical significance between ureteroscope and cystoscope for patients

received radiotherapy. The reason might be that both of them could use the electro-resection equipment to find the ureteral orifice.

According to our work, the success rate was high for the patients with ureteral stricture and incomplete obstruction, because the local mucosal was continuous. It was the key to find normal tract by extrusion and avoid false way and perforation. The interaction between guide wire and ureteroscope can improve the success rate of exploratory surgery to renal pelvis under visualize. The holmium laser can be used to burn partial tissue to widened inner diameter and reduce the occurrence of postoperative restenosis.

It is difficult for the patients with complete ureteral occlusion, due to disappearance of normal cavity. The interaction between the holmium laser and ureteroscope is conducive to establish the channel for catheter, which is discussed in other articles[14-16]. The incision helps to pass the guide wire through the obstruction. If the obstruction is complete, the increase of the water pressure can lead to the increase of pressure in cavity, but slow flow cannot keep clear field. It is dangerous to burn tumor considering of ureter perforation in this situation. After the expansion by the ureteroscope along guide wire, clear flow is favorable to make sure the continuity and trend of the ureter. The holmium laser can further overcome the obstruction by burning. If accident perforation occurs, ureteroscope should be relocated at the distal of obstruction, and guide wire plays an important role to explore a new path repeatedly. The surgeon should recognize the space between tumor and ureter, and double-J stent can keep the ureteral continuity to facilitate the repair of fistula. Stents special for cancer is needed, considering of postoperative relapse caused by tumor's advance.

For the stitched ureter, the holmium laser can be used to cut sutures and release ureteral obstruction. At the same time, suture should be picked out to avoid the lithogenesis around it.

It is the key to successful retrograde catheterization for ureter transection injury whether the proximal lacerated end can be found or not. The successful cases reported that ureter realignment for iatrogenic injury was assisted by percutaneous and transurethral ureteroscope, but it was not suitable for patients with long history of ureteral obstruction[17].

The lesion near indistinct ureteral orifice can be cut assisted by cystoscope for clear identification, which includes the tumor's invasion into bladder trigone, ureteral stitching, radio-cystitis, and disuse atrophy. Resectoscope or cystoscope has better vision than ureteroscope, especially 30° scope that is fit to observe ureteral orifice raised by the advanced tumor. Because the contracture or stenosis of ureteral orifice is a late complication in general, the advanced patients can receive perennial catheter assisted by transurethral incision, considering of their survival time. There are two tips for the transurethral excision process: 1- intraoperative and postoperative hemostasis are needed. It seems to be a disadvantage for ureteroscope, because it is lack of water cycle and difficult to keep clear vision. 2- The transurethral incision should be controlled to avoid the perforation and separation of the ureter from bladder.

Conclusions

Ureteroscopic stent placement with the use of holmium laser or plasma kinetic resection device is a novel option, especially secondary to gynecological tumors, that is introduced for the first time. This technology has good clinical effect and safety, which provides a relatively simple and minimal-invasive treatment choice to resolve middle and lower ureteral obstruction caused by complex gynecological factors.

Acknowledgements

This work was supported by the National Natural Science Foundation of China (81602217), the Science and Technology Planning Project of Zhejiang Province (2015C33096), and the Medical Scientific Research Foundation of Zhejiang Province (2015117161). The sponsors played no direct role in the study.

Conflict of Interest

No potential conflicts of interest were disclosed.

References

1) Klap J, Phe V, Chartier-Kastler E, Mozer P, Bitker MO, Roupret M. [Aetiology and management of iatrogenic injury of the ureter: A review]. Prog Urol 2012; 22: 913-919.
2) Uncu Y, Karahasan M, Uyaniklar O, Uncu G. Prophylactic misoprostol for the prevention of postpartum hemorrhage: a randomized controlled trial. Eur Rev Med Pharmacol Sci 2015; 19: 15-22.
3) Yang G, Zeng G, Wu JP, Jiang O, Zeng YB, Huang SJ, Huang JJ, Wu DQ. Glipizide blocks renal

interstitial fibrosis by inhibiting AKT signaling pathway. Eur Rev Med Pharmacol Sci 2017; 21: 867-872.
4) Tsuru N, Mugiya S, Sato S. Retrograde flexible ureteroscopy-assisted retroperitoneal laparoscopic ureteroureterostomy for refractory ureteral stricture: a case report. Int J Surg Case Rep 2016; 20: 77-79.
5) Danilovic A, Antonopoulos IM, Mesquita JL, Lucon AM. Likelihood of retrograde double-J stenting according to ureteral obstructing pathology. Int Braz J Urol 2005; 31: 431-436.
6) Chitale SV, Scott-Barrett S, Ho ET, Burgess NA. The management of ureteric obstruction secondary to malignant pelvic disease. Clin Radiol 2002; 57: 1118-1121.
7) Annan AC, Stevens KA, Osunkoya AO. Urothelial carcinoma involving the ureteral orifice: a clinicopathologic analysis of 93 cases. Hum Pathol 2017; 65: 101-106.
8) Uthappa MC, Cowan NC. Retrograde or antegrade double-pigtail stent placement for malignant ureteric obstruction? Clin Radiol 2005; 60: 608-612.
9) Allen DJ, Longhorn SE, Philp T, Smith RD, Choong S. Percutaneous urinary drainage and ureteric stenting in malignant disease. Clin Oncol (R Coll Radiol) 2010; 22: 733-739.
10) Hausegger KA, Portugaller HR. Percutaneous nephrostomy and antegrade ureteral stenting: technique-indications-complications. Eur Radiol 2006; 16: 2016-2030.
11) Jalbani MH, Deenari RA, Dholia KR, Oad AK, Arbani IA. Role of percutaneous nephrostomy (PCN) in malignant ureteral obstruction. J Pak Med Assoc 2010; 60: 280-283.
12) Wilson JR, Urwin GH, Stower MJ. The role of percutaneous nephrostomy in malignant ureteric obstruction. Ann R Coll Surg Engl 2005; 87: 21-24.
13) Chen IH, Tsai JY, Yu CC, Wu T, Huang JK, Lin JT. Ureteroscope-assisted double-J stenting following laparoscopic ureterolithotomy. Kaohsiung J Med Sci 2014; 30: 243-247.
14) Giddens JL, Grasso M. Retrograde ureteroscopic endopyelotomy using the holmium: YAG laser. J Urol 2000; 164: 1509-1512.
15) Razdan S, Silberstein IK, Bagley DH. Ureteroscopic endoureterotomy. Bju Int 2005; 95 Suppl 2: 94-101.
16) Hyams ES, Munver R, Bird VG, Uberoi J, Shah O. Flexible ureterorenoscopy and holmium laser lithotripsy for the management of renal stone burdens that measure 2 to 3 cm: a multi-institutional experience. J Endourol 2010; 24: 1583-1588.
17) Spatafora S, Buli P, Leoni S. Combined percutaneous-transurethral incision for treatment of ureterocele in adults. Urology 2006; 68: 1333-1335.