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*Original article*

# Forgotten ureteral stents: Risk factors, complications and management

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**Abstract**
*Objectives:* To assess complications of neglected stents, risk factors for the occurrence of complications, and management options and outcomes.
*Subjects and methods:* A prospective study including patients presenting to our center with neglected polyurethane ureteral stents (indwelling for more than 6 months in the period from February 2012 to September 2015). We noted the complications of neglected stents (urinary tract infections (UTI), urinary obstruction, elevated creatinine, encrustations and stent fragmentation), management challenges (need for complex endo-urologic or open procedures). We evaluated potential risk factors for these complications (duration of stenting, lack of urinary acidification, cause of stent placement).
*Results:* The study included 68 patients with mean age 49.3 ± 12.6 years 80.9% were males. Mean stenting duration 17.3 ± 12.7 months. A total of 29% of patients received urine acidifier while the stent was indwelling, 92% were stone formers, 60% presented with UTI and 25% presented with elevated creatinine. Preoperative non-contrast spiral CT abdomen and pelvis showed encrustations on the stent in 23.5% of patients and fragmented stent in 13%. The stent was removed by cystoscopy only as an outpatient procedure in 26 (38.3%) cases (7 of them with encrustation) while 42 (61.7%) cases needed more than simple cystoscopy. Management challenges included need for complex endourological interventions (URS, PCNL, cystolithotripsy or even open surgery). Lack of urinary acidification was a significant risk factor for UTI and stent fragmentation (P-value = 0.038 and 0.006, respectively). Stone former patients needed complex interventions (P = 0.046). UTIs were more likely with longer duration of stenting (P = 0.027).
*Conclusion:* Forgotten ureteral stents are associated with significant complications. Urinary acidification is protective against complications. Patients with stones are more liable to forgotten stents complications.



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## Introduction

Ureteral stents are hollow tubes which drain the kidneys into the urinary bladder through the ureteric lumen. They were first described in 1967 and since that time there were many advances in the ureteric stent design regarding the material, shape and coating [1].

Ureteral stent placement is important to many urologic procedures such as extracorporeal shock wave lithotripsy (SWL) and ureteroscopy [2]. Ureteral stents may also be useful for many conditions such as hydronephrosis due to stone disease, pregnancy and a malignant neoplasm [3]. The indications for stent insertion have increased during the last years and ureteral stents are inserted as an almost routine procedure in patients with ureteric obstruction. Thus the complications of stents become also more frequent than before [4].

Despite their advantages, ureteral stents are not without possible morbidity. Many patients complain of symptoms related to stent placement; stents may cause complications, and certain management issues may arise from their use. Forgotten ureteral stents can cause a spectrum of complications ranging from hematuria, stent occlusion, migration, fragmentation, encrustation, and stone formation to serious complications like recurrent urinary tract infection (UTI), urinary tract obstruction, and renal failure [5,6]. Even fistula formation to the iliac arteries is known [7]. Mortality has also been reported [8].

The removal of ureteric stents is one of the most simple endourologic maneuvers, yet the removal of the neglected ureteric stent may be one of the most complicated endourological maneuvers as the loss of its tensile character due to neglect may lead to its breakage and fragmentation.

In this study, we evaluate the outcome of neglected ureteric stents and their complications, with a focus on the risk factors for these complications, and management options.

## Subjects and methods

This was a prospective, cohort observational study conducted at the department of urology, Cairo University. Sixty eight patients were included in the period from February 2012 to September 2015. All the patients presenting to the urology outpatient clinic with polyurethane ureteral stents for more than six months, above the age of eighteen years, irrespective to the gender were included in the study. The patients with a ureteral stent in situ for a prolonged period with regular change every 6 months or with non-polyurethane ureteral stents were excluded from the study. The study was performed in compliance with the ethics principles of the 1975 Declaration of Helsinki. A written informed consent was obtained from all patients. The study protocol, as well as the suggested informed consent, were approved by the Institutional Review Board (IRB) before the start of enrolling participants.

The patients were evaluated preoperatively using a pre-designed sheet including history of previous stone formation, indications for initial stent placement, duration of stent in urinary system, the presenting complaints, the use of urine acidifier along the duration of the stent. Preoperative baseline investigations as complete blood count, coagulation profile, kidney and liver function tests, urine analysis and culture were done. The midstream of urine was collected in all cases for urine culture. All patients were evaluated for stent complications by abdominopelvic ultrasound, plain X-ray, non-contrast spiral CT abdomen and pelvis and/or excretory urography. Treatment decisions were based on clinical and radiological findings. All patients with infected urine were treated preoperatively to have negative urine culture before intervention, and prophylactic antibiotics were given to all cases.

In cases with minimal encrustation on the stent, a gentle attempt was made to remove the stent using a grasping forceps through the cystoscope under fluoroscopic guidance. In cases with marked encrustation or stone burden on the lower coil of the stent only, we started with cystolithotripsy then tried to remove the stent. In cases with marked encrustations along the stent or failed simple traction by the cystoscope, retrograde study was done by a 6 Fr Teflon ureteral dilator then a 0.035-in. straight floppy tipped guide wire was advanced through the dilator into the renal pelvis, under fluoroscopic guidance. The guide wire was kept inside the ureter all through the whole technique. Ureteroscopy was performed by a semi-rigid (9.5 Fr or 12.5 Fr) ureteroscope ("Karl Storz" 43 cm length, angled 6-degree telescope, with 6 Fr central channel) and intracorporeal lithotripsy to the ureteric encrustations or stones using a pneumatic lithotripter or a holmium: YAG laser, then we performed a gentle trial to retrieve the stent using the ureteroscopic forceps. If the stent failed to uncoil, fragmented stent, or in cases with large renal stones around the stent coil, a ureteric catheter was placed adjacent to the stent and the patient was placed in the prone position for percutaneous nephrolithotomy (PCNL) of the upper coil or the renal stone using a rigid 24F nephroscope. The ureteral stent was replaced by another one in selected cases according to patient's situation. Cystolithotomy, ureterolithotomy or pyelolithotomy were required in certain cases with large stone burden.

Plain X-ray was performed to all patients early postoperatively to ensure that they became stent and stone free. Stone or encrustations analysis was done in all cases. After one month all patients were interviewed to confirm the absence of symptoms and exclude new symptoms. Urine analysis and culture, serum creatinine and abdominopelvic ultrasound to exclude hydronephrosis were done after one month.

We studied the effect of different risk factors (stent duration, lake of urine acidification, history of stone formation, and elevated creatinine) on the complications of forgotten ureteral stents (urinary infection, encrustation, stent fragmentation, complicated endoscopic technique and postoperative need of stent replacement).

Statistical analyses were performed using IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY). Continuous variables were tested for normality by the Kolmogorov–Smirnov test. Normally distributed data were presented as means ± standard deviation. The rates and proportions of discrete variables were determined using the chi-squared test. The median with data range (minimum to maximum) was used for non-normally distributed data. The independent samples Mann–Whitney U test was used for nonparametric groups. The two-sided P value of $<0.05$ was considered statistically significant.