

# Analysis of 79 Patients with Forgotten Ureteral Stents: 10-Year Experience in a Single Tertiary Care Center

## Unutulmuş Üreteral Stentli 79 Hastanın Analizi: Tek Bir Üçüncü Basamak Merkezinin 10 Yıllık Deneyimi

Mubariz Aydamirov<sup>1</sup> , Kadir Karkin<sup>2</sup> , Zafer Gökhan Gürbüz<sup>2</sup> 

<sup>1</sup>Department of Urology, Başkent University, Alanya Application and Research Center, Antalya, Türkiye  
<sup>2</sup>Department of Urology, Adana City Training and Research Hospital, Adana, Türkiye

**Cite as:** Aydamirov M, Karkin K, Gürbüz ZG. Analysis of 79 patients with forgotten ureteral stents: 10-year experience in a single tertiary care center. Grand J Urol 2025;5(1):13-7

**Submission date:** 03 October 2024 **Acceptance date:** 19 December 2024 **Online first:** 24 December 2024 **Publication date:** 20 January 2025

**Corresponding Author:** Mubariz Aydamirov / Başkent University, Alanya Application and Research Center, Department of Urology, Antalya, Türkiye  
aydamirov.89@mail.ru / ORCID ID: 0000-0002-7197-3585

### Abstract

**Objective:** Double J (DJ) stents are frequently used, especially in urological surgeries, to relieve obstruction and provide urine flow from the kidney to the bladder, to heal the ureter, and to prevent complications. In the literature, it was determined that up to 12% of patients with ureteral stents have forgotten ureteral stents (FUS). In this study, we aimed to present our 10-year experience of FUS treatment.

**Materials and Methods:** The medical records of patients treated with the diagnosis of FUS (those with stents for >6 months) between January 2014 and June 2024 were retrospectively reviewed. The reasons for the DJ stent placement, the center where the stent was placed (those placed in our own clinic and forgotten or those placed in an external center and forgotten and referred to us), duration of the stent, symptoms at presentation, and treatments performed were noted.

**Results:** The study included 79 patients. The mean age of the patients was 49.4±21.3 years, with a range of 25-90 years. Of patients, 60.8% were unaware of the presence of a stent. The mean stent duration was 24±39.4 months (range 6-300 months) and 52 (65.8%) patients had encrustation. There were 4 (5.1%) patients with solitary kidneys. The mean postoperative hospitalization time was 5.6±4.5 days. The majority of patients underwent DJ stent placement after ureteroscopic lithotripsy (34.2%) and due to obstructed ureteral stones (31.5%). The most common symptoms at presentation were storage lower urinary tract symptoms (22.8%), dysuria (21.5%), recurrent urinary tract infection (16.5%) and flank pain (15.2%). Three (3.8%) patients underwent open nephrectomy due to non-functioning kidney. All remaining patients were treated endoscopically.

**Conclusion:** FUS often causes more morbidity than treatment of the primary disease. Although it can be successfully treated with endourological surgeries, the main goal should be to prevent the development of this complication.

**Keywords:** endoscopic surgical procedure, ureteral calculi, urolithiasis, urinary catheters

### Özet

**Amaç:** Özellikle ürolojik cerrahilerde obstrüksiyonun giderilip böbrekten mesaneye idrar akışının sağlanması, üreterin iyileşmesi ve komplikasyonların önlenmesi amacıyla double-J (DJ) stentler sıklıkla kullanılmaktadır. Literatürde üreteral stent takılan hastaların %12'ye kadarında unutulmuş üreteral stent (FUS) olduğu saptanmıştır. Bu çalışmada biz FUS tedavisinde 10 yıllık kendi deneyimlerimizi sunmayı amaçladık.

**Gereçler ve Yöntemler:** Ocak 2014 ile Haziran 2024 tarihleri arasında FUS (>6 ay stenti olanlar) tanısıyla tedavi edilen hastaların tıbbi kayıtları retrospektif olarak incelendi. Hastaların DJ stent takılma nedenleri, stentin takıldığı merkez (kendi kliniğimizde takılan ve unutilan veya dış merkezde takılıp unutilul bize başvuranlar), stentli kalma süreleri, başvuru semptomları ve yapılan tedaviler not edildi.

**Bulgular:** Çalışmaya 79 hasta dahil edildi. Hastaların ortalama yaşı 49.4±21.3 yıl olup yaş aralığı 25-90 yıl idi. Hastaların %60,8'i stent varlığından habersizdi. Ortalama stent süresi 24±39.4 ay (6-300 ay) idi ve 52 (%65,8) hastada enkrustasyon vardı. Soliter böbrekli 4 (%5,1) hasta vardı. Ameliyat sonrası ortalama hastanede kalış süresi 5.6±4.5 gündü. Hastaların büyük çoğunluğuna üreteroskopik litotripsi sonrası (%34,2) ve obstrükte üreter taşları nedeniyle (%31,5) DJ stent takıldı. Başvuru anındaki en sık görülen semptomlar depolama alt üriner sistem semptomları (%22,8), dizüri (%21,5), tekrarlayan üriner sistem enfeksiyonu (%16,5) ve yan ağrısı (%15,2) idi. Non-fonksiyone böbrek nedeniyle 3 (%3,8) hastaya açık nefrektomi operasyonu uygulandı. Geri kalan hastaların tamamı endoskopik olarak tedavi edildi.

**Sonuç:** FUS sıklıkla primer hastalık tedavisinden daha çok morbiditeye neden olmaktadır. Her ne kadar endoürolojik ameliyatlara başarılı tedavi edilebilse de bu komplikasyonun gelişiminin önlenmesi ana hedef olarak belirlenmelidir.

**Anahtar kelimeler:** endoskopik cerrahi işlemler, ureter taşı, ürolitiazis, üriner kateterler

**ORCID ID:** K. Karkin 0000-0002-4324-3032 Z.G.Gürbüz 0000-0002-7325-1965

## Introduction

Ureteral double-J (DJ) stents have an important place in urology practice. DJ stents are frequently used, especially in urological surgeries, to relieve obstruction and provide urine flow from the kidney to the bladder, to heal the ureter, and to prevent complications. Historically, Zimskind et al. first relieved ureteral obstruction by endoscopically inserting a DJ stent in 1967 [1]. However, ureteral stents have a certain period of use. In general, they must be removed or replaced within 6 weeks to 6 months. This is because, in addition to their serious benefits, there is serious literature information indicating that they increase morbidity and mortality when they remain longer than the specified periods [2-4]. It is very important to comply with this period and to raise awareness of patients. However, despite it being explained many times in writing and verbally, some patients forget that they have a stent. In the literature, it was determined that up to 12% of patients with ureteral stents have forgotten ureteral stents (FUS) [5]. Studies about the complications of FUS found that DJ stent occlusion, encrustation, migration, stone formation, hydronephrosis, renal failure, sepsis and even death may occur [6].

Another important issue with FUS is how the stent duration affects treatment. When we look at the studies, it is more difficult to treat stents that remain in place for more than one year [7]. In addition, treatment approaches may vary depending on the location and size of encrustation and whether the stent is fragmented or not. Extracorporeal shockwave therapy (ESWL), endoscopic cystolithotripsy (EnCLT), ureteroscopic lithotripsy (URLS), percutaneous nephrolithotomy (PCNL) and open surgery can be performed for the management of FUS complications [7,8]. In this study, we aimed to present our 10-year experience of FUS treatment.

## Materials and Methods

After obtaining approval from the local ethics committee of Adana City Training and Research Hospital (Date: 11.09.2024, Approval No:5/145), the medical records of patients treated with the diagnosis of FUS (those with stents for >6 months) between January 2014 and June 2024 were retrospectively reviewed.

The reasons for the DJ stent placement, the center where the stent was placed (those placed in our own clinic and forgotten or those placed in an external center and forgotten and referred to us), duration of the stent, symptoms at presentation, and treatments performed were noted. All patients underwent serum creatinine level, complete blood count, urinalysis, urine culture, direct urinary system radiography, and ultrasound before treatment. Non-contrast computed tomography was performed in patients with complicated (fragmented/migrated stent) and radiolucent stones. Those with urinary tract infections before surgery were treated. Single dose cephalosporin prophylaxis was administered before all procedures.

EnCLT, URLS and PCNL surgeries were performed to manage complications related to FUS and to remove the stent. In patients with minimal encrustation observed on preoperative imaging, cystoscopy-guided stent removal was attempted. In patients with encrustation at the lower end of the stent, enCLT was performed with a pneumatic lithotripter in the dorsal

lithotomy position. The stent was then gently removed with a ureteroscopic grasper. If the stents could not be removed, a ureteral catheter was placed next to the stents to visualize the collecting system with radiocontrast injection. The patient was placed in the prone position and PCNL was performed and the stent was removed. In patients with encrustation of the ureter, retrograde URLS was performed under fluoroscopic guidance using semirigid ureteroscope. Nephrectomy was performed in patients with non-functioning kidneys.

## Statistical Analysis

Qualitative variables are expressed as frequency and percentage. Age, indwelling time of stent, and hospitalization time are shown as mean and standard deviation.

## Results

The study included 79 patients. The mean age of the patients was  $49.4 \pm 21.3$  years, with a range of 25-90 years. Of patients, 60.8% were unaware of the presence of a stent. The mean stent duration was  $24 \pm 39.4$  months (range 6-300 months) and 52 (65.8%) patients had encrustation. There were 4 (5.1%) patients with solitary kidneys. The mean postoperative hospitalization time was  $5.6 \pm 4.5$  days. Demographic and clinical data of the patients are summarized in **Table 1**.

**Table 1.** Demographic and clinical data of patients

Parameters	
Age, years (mean $\pm$ SD)	49.4 $\pm$ 21.3
<b>Nationality, n (%)</b>	
Turkish	65 (82.3)
Syrian	14 (17.7)
<b>Gender, n (%)</b>	
Male	54 (68.4)
Female	25 (31.6)
<b>Stent inserted center, n (%)</b>	
Our clinic	43 (54.4)
Other clinic	36 (45.6)
<b>Reasons, n (%)</b>	
Forgot	31 (39.2)
Did not know	48 (60.8)
<b>Indwelling time (months)</b>	24 $\pm$ 39.4
<b>Site, n (%)</b>	
Right	41 (51.9)
Left	38 (48.1)
<b>Stent related complications, n (%)</b>	
Encrustation	52 (65.8)
Migration	7 (8.9)
Fragmentation	3 (3.8)
<b>Solitary kidney, n (%)</b>	4 (5.1)
<b>Hydronephrosis presence, n (%)</b>	18 (22.8)
<b>Hospitalization time (days)</b>	5.6 $\pm$ 4.5

The majority of patients underwent DJ stent placement after URSL (34.2%) and due to obstructed ureteral stones (31.5%) (**Table 2**). The reasons for DJ stent placement are shown in Table 2.

The most common symptoms at presentation were storage lower urinary tract symptoms (LUTS) (22.8%), dysuria (21.5%), recurrent urinary tract infection (UTI) (16.5%) and flank pain (15.2%) (**Table 3**). The complaints of the patients at presentation are summarized in Table 3.

Three (3.8%) patients underwent open nephrectomy due to non-functioning kidney. All remaining patients were treated endoscopically. EnCLT and URSL treatments were applied in a single session, while a second session was performed in cases requiring PCNL. The stents of 22 (27.8%) patients with FUS were extracted by grasping them with forceps during simple cystoscopy in a single session. After treatment, stents were re-implanted in 23 patients and removed after 6 weeks. Treatments performed for FUS are summarized in **Table 4**.

## Discussion

One in every ten patients who receive ureteral stents is diagnosed with FUS. The definition of FUS varies among studies (>3, >6, >12 months) [8]. While stents cause symptoms such as dysuria, hematuria, urgency, frequency, and flank pain in the early period, serious conditions such as stent obstruction, migration, encrustation, spontaneous fragmentation, ureteroarterial and ureterointestinal fistula can develop in the late period [9]. It is a known fact that the longer the FUS period, the higher the frequency of complications and the severity of the complications [8].

The presenting symptoms were addressed in many studies in the literature. Patil et al. stated that the most common presenting symptoms were dysuria (80%) and storage LUTS (53.3%) in their study with 30 patients [7]. Damiano et al. found that flank pain (25.3%) and storage LUTS (18.8%) were common [10]. It was also observed that as the indwelling time of the DJ stent increased, the possibility of bacterial colonization and infection increased [11]. This risk is higher in women especially and dysuria, storage LUTS, recurrent UTI and flank pain complaints are the main symptoms of patients [12].

As the stent duration increases, the probability of encrustation increases [13]. Encrustation is usually observed at the proximal and distal ends of stents. The mid-ureteral parts are less, or mildly, encrusted [8]. In a study investigating the causes of encrustation, a history of past stones increased encrustation at the proximal end of the stent, while patient age and urinary tract infection increased encrustation at the distal end [14]. In one study, the encrustation rate was reported as 76.3% in stents that remained in place for more than 12 weeks [15]. In another study including 69 patients with stent duration of more than six months, the encrustation rate was found to be 73.9% and the encrustation size increased as the duration increased [16]. Jain et al. found that the encrustation size was large in those with a history of urinary system stone disease [17]. This study included FUS patients with a duration of more than 6 months and the overall encrusting rate was 65.8%. In 38 patients, the stent indwelling time was more than 12 months and the encrustation rate was 81.6%. If we look at the reasons for DJ stent placement in the literature, Patil et al. [7] reported that DJ stents were most frequently placed after URSL and PCNL, and Al-Hajjaj et al. [18] reported that DJ stents

**Table 2.** Reasons for Double-J stent placement

Parameters	n, (%)
Infection	3 (3.8)
URSL	27 (34.2)
ESWL	1 (1.3)
PCNL	6 (7.6)
Pregnancy	2 (2.5)
Cystectomy	1 (1.3)
Trauma	1 (1.3)
Retroperitoneal fibrosis	1 (1.3)
Urolithiasis	25 (31.5)
Ureteral compression (malign)	3 (3.8)
Unknown	9 (11.4)

URSL: ureteroscopy lithotripsy; ESWL: extracorporeal shockwave lithotripsy; PCNL: percutaneous nephrolithotomy

**Table 3.** Presenting symptoms of patients

Parameters	n, (%)
Fever	2 (2.5)
Dysuria	17 (21.5)
Hematuria	6 (7.6)
Flank pain	12 (15.2)
Storage LUTS	18 (22.8)
Recurrent UTI	13 (16.5)
Asymptomatic	11 (13.9)

LUTS: lower urinary tract symptoms; UTI: urinary tract infection

**Table 4.** Forgotten Double-J stents treatment methods

Parameters	n, (%)
SCSR	22 (27.8)
SCSR with EnCLT	9 (11.4)
SCSR with URSL	15 (19)
EnCLT and URSL and SCSR	11 (13.9)
EnCLT and PCNL and antegrade SR	2 (2.5)
URSL and PCNL and antegrade SR	6 (7.6)
PCNL and antegrad SR	4 (5.1)
EnCLT and URSL and PCNL and antegrade SR	7 (8.9)
Open nephrectomy	3 (3.8)

SCSR: simple cystoscopic stent removal; EnCLT: endoscopic cystolithotripsy; URSL: ureteroscopy lithotripsy; PCNL: percutaneous nephrolithotomy; SR: stent removal

were frequently placed after URSL. In our study, similar to the literature, DJ stents were placed in most patients either due to obstructed ureteral stones or after URSL.

Although there is no definitive treatment algorithm for FUS, treatment decisions should be made after evaluating imaging findings (encrustation, stone size, migration, fragmentation) and renal function. While stents can be removed in some patients with simple cystoscopy, combined endourological treatments can be applied in complicated cases. The presence of stones in the proximal part of the stent is associated with an increase in the number of sessions, a prolongation of the treatment period, and an increase in complications [16,19]. In one study, 15 ureteral stents that remained in place for 20 months could not be removed by simple cystoscopy [20]. Mahmood et al., in their study with 52 FUS (stent duration >3 months), mostly applied cystoscopic stent removal, URSL and combined endourological treatments [21]. Gupta et al. frequently used cystoscopy and ureteroscopy methods to remove stents in 23 FUS (stent duration >6 months) patients [9]. In the study by Patil et al. (stent duration >6 months), ureteroscopy and PCNL methods were applied more [7]. In this study, endourological surgeries were applied more, in line with the literature.

The use of ESWL in the management of FUS patients has been shown in studies [21,22]. However, this method does not provide sufficient benefit in patients with severe encrustation and high stone burden [8]. However, it may increase the success of endourological treatments [23]. There were patients in our center who used ESWL for FUS treatment, but we did not include them in the study because ESWL was mostly unsuccessful in these patients and patient data were insufficient.

In order to prevent FUS and related complications, detailed information should be provided to patients who have DJ stents after urological surgeries, the complications that may develop when the stent remains in place for longer than the specified period should be explained, adequate fluid intake should be encouraged, stone prophylaxis should be initiated in appropriate patients and antimicrobial treatments should be applied for prophylaxis [8]. In order to prevent FUS development, McCahy et al. kept records of those who had DJ stents on the computer and developed a model that reminded the urologist about the expired stents [24]. Patients can also be reminded verbally by e-mail, SMS (short message service, or text message) or by calling their registered numbers when their stent expiration date has passed [22].

If we look at the limitations of our study, the small number of patients, being a single-center study, the absence of postoperative complication data, the absence of stone analysis, and the absence of cost analysis are the main limitations of the study.

## Conclusion

FUS often causes more morbidity than treatment of the primary disease. Although it can be successfully treated with endourological surgeries, the main goal should be to prevent the development of this complication.

**Ethics Committee Approval:** This study was performed according to the Helsinki Declaration and with permission from the local ethics committee of Adana City Training and Research Hospital (Date: 11.09.2024, Approval No:5/145).

**Informed Consent:** An informed consent was obtained from all the patients.

**Publication:** The results of the study were not published in full or in part in form of abstracts.

**Peer-review:** Externally peer-reviewed.

**Authorship Contributions:** Any contribution was not made by any individual not listed as an author. All authors read and approved the final version of the manuscript. Concept – M.A., K.K., Z.G.G.; Design – M.A., K.K.; ZGG.; Supervision – K.K., Z.G.G.; Resources – M.A.; Materials – K.K.; Data Collection and/or Processing – M.A., K.K.; Analysis and/or Interpretation – M.A., Z.G.G.; Literature Search – M.A., K.K.; Writing Manuscript – M.A., K.K.; Critical Review – M.A., K.K., Z.G.G.

**Conflict of Interest:** The authors declare that they have no conflicts of interest.

**Financial Disclosure:** The authors declare that this study received no financial support.

## References

- [1] Zimskind PD, Fetter TR, Wilkerson JL. Clinical use of long-term indwelling silicone rubber ureteral splints inserted cystoscopically. *J Urol* 1967;97(5):840–4. [https://doi.org/10.1016/S0022-5347\(17\)63130-6](https://doi.org/10.1016/S0022-5347(17)63130-6)
- [2] Borboroglu PG, Kane CJ. Current management of severely encrusted ureteral stents with a large associated stone burden. *J Urol* 2000;164(3Pt1):648–50. <https://doi.org/10.1097/00005392-200009010-00007>
- [3] Bukkapatnam R, Seigne J, Helal M. 1-step removal of encrusted retained ureteral stents. *J Urol* 2003;170 (4 Pt 1):1111–4. <https://doi.org/10.1097/01.ju.0000086042.36616.1b>
- [4] Kawahara T, Ito H, Terao H, Yamagishi T, Ogawa T, Uemura H, et al. Ureteral stent retrieval using the crochet hook technique in females. *PloS one* 2012;7(1):e29292. <https://doi.org/10.1371/journal.pone.0029292>
- [5] Distler FA, Veelken R, Wagner A, Klein T, Huettenbrink C, Pahernik S. A forgotten ureteral stent: Potential risks for the urinary function. *Urol Int* 2022;106(2):209–12. <https://doi.org/10.1159/000518503>
- [6] Vajpeyi V, Chipde S, Khan FA, Parashar S. Forgotten double-J stent: Experience of a tertiary care center. *Urol Ann* 2020;12(2):138–143. [https://doi.org/10.4103/UA.UA\\_73\\_19](https://doi.org/10.4103/UA.UA_73_19)
- [7] Patil S, Raghuvanshi K, Jain DK, Raval A. Forgotten ureteral double-J stents and related complications: a real-world experience. *Afr J Urol* 2020;26(1):8. <https://doi.org/10.1186/s12301-020-0020-3>
- [8] Wang X, Ji Z, Yang P, Li J, Tian Y. Forgotten ureteral stents: a systematic review of literature. *BMC Urol* 2024;24(1):52. <https://doi.org/10.1186/s12894-024-01440-9>

- [9] Gupta S, Maurya A, Pal D. Complications of long term indwelling double j stent and their management: A single centre experience. *Sch. J. App. Med. Sci* 2017;5(8D):3304-8. <https://www.researchgate.net/>
- [10] Damiano R, Oliva A, Esposito C, De Sio M, Autorino R, D'Armiento M. Early and late complications of double pigtail ureteral stent. *Urol Int* 2022;69(2):136–140. <https://doi.org/10.1159/000065563>
- [11] Farsi HM, Mosli HA, Al-Zemaity MF, Bahnassy AA, Alvarez M. Bacteriuria and colonization of double-pigtail ureteral stents: long-term experience with 237 patients. *J Endourol* 1995;9(6):469–72. <https://doi.org/10.1089/end.1995.9.469>
- [12] Joshi R, Singh DR, Sharma S. Lower urinary tract infection and bacterial colonization in patient with double J ureteral stent. *J Nepal Health Res Counc* 2011;9(2),165–8. <https://pubmed.ncbi.nlm.nih.gov/22929847/>
- [13] el-Faqih SR, Shamsuddin AB, Chakrabarti A, Atassi R, Kardar AH, Osman MK, et al. Polyurethane internal ureteral stents in treatment of stone patients: morbidity related to indwelling times. *J Urol* 1991;146(6):1487–91. [https://doi.org/10.1016/s0022-5347\(17\)38146-6](https://doi.org/10.1016/s0022-5347(17)38146-6)
- [14] Sighinolfi MC, Sighinolfi GP, Galli E, Micali S, Ferrari N, Mofferdin A, et al. Chemical and mineralogical analysis of ureteral stent encrustation and associated risk factors. *Urology* 2015;86(4):703–6. <https://doi.org/10.1016/j.urology.2015.05.015>
- [15] Nerli RB, Magdum PV, Sharma V, Guntaka AK, Hiremath MB, Ghagane S. Forgotten/retained double J ureteric stents: A source of severe morbidity in children. *Afr J Paediatr Surg* 2016;13(1):32–5. <https://doi.org/10.4103/0189-6725.181704>
- [16] Kartal IG, Baylan B, Gok A, Sagnak AL, Karakoyunlu N, Cakici MC, et al. The association of encrustation and ureteral stent indwelling time in urolithiasis and KUB grading system. *Urol J* 2018;15(6):323–8. <https://doi.org/10.22037/uj.v0i0.4592>
- [17] Jain R, Chaparala H, Omar M, Ganesan V, Sivalingam S, Noble M, et al. Retained ureteral stents at a tertiary referral stone center- Who is at risk? *Urol Pract* 2018;5(6):452–7. <https://doi.org/10.1016/j.urpr.2017.09.005>
- [18] Al-Hajjaj M, Alam OA, Abu-Hussein B, Muhammad Al Husein HA. Forgotten Double-J ureteral stent: An analysis of 25 cases in a tertiary hospital. *Ann Med Surg (Lond)* 2022;80:104223. <https://doi.org/10.1016/j.amsu.2022.104223>
- [19] Mistry K, Pal P, Chitale S. A. simple two-stage “bailout” technique for the removal of an unyielding ureteric stent. *Urology* 2013;82(1):242–4. <https://doi.org/10.1016/j.urology.2013.02.036>
- [20] Okuda H, Yamanaka M, Kimura T, Takeyama M. Case of multiple encrusted stones on the ureteral stent left for 7 years: the efficacy of extracting the ureteral stent on transurethral lithotripsy. *Nihon Hinyokika Gakkai Zasshi* 2009;100(6):635–9. <https://doi.org/10.5980/jpnjuro.100.635>
- [21] Mahmood K, Singh KH, Upadhyay R, Kumar V, Kumar A, Singh DK. Management of forgotten double-J stent in a tertiary care center with ten years of experience: a retrospective study. *Int Surg J* 2020;23;7(8):2615-20. <https://doi.org/10.18203/2349-2902.isj20203243>
- [22] Anwar MS, Farooq M, Ayub M, Shah AA, Akhter SH, Qureshi AM. Management of forgotten ureteral double J stents: causes and management. *Ann Punjab Med Coll* 2017;12;11(3):227-32. <https://scholar.archive.org/>
- [23] Irkilata L, Ozgur BC, Sancaktutar AA, Akdeniz E, Aydin M, Demirel HC, et al. Extracorporeal shock wave lithotripsy in the primary treatment of encrusted ureteral stents. *Urolithiasis* 2015;43(4):379–84. <https://doi.org/10.1007/s00240-015-0782-4>
- [24] McCahy PJ, Ramsden PD. A computerized ureteric stent retrieval system. *Br J Urol* 1996;77(1): 147–8. <https://doi.org/10.1046/j.1464-410x.1996.87626.x>