

Forgotten Ureteral Stents: Who's at Risk?

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Abstract

The sequelae from forgotten stents carry significant morbidity and costs. In this study, we attempt to identify potential risk factors that may make patients less likely to follow up for stent removal so that more effective prevention efforts may be directed at these persons. A single-institution retrospective analysis of 187 consecutive patients who had stents placed between January 2010 and December 2010 was performed. Chart review was conducted to see if patients had undergone stent removal beyond the intended maximal stent life (MSL). Patients who were lost to follow-up were contacted to determine if stents were overdue. Logistic regression was performed to determine risk factors. Of the 187 patients who had stents placed, 147 had the stent removed before MSL and 28 had stents removed after the MSL. Twelve patients could not be contacted and were excluded from the analysis. Within our cohort of 175 patients, 48% were males, 73% were minorities (33% Latino, 30% Black, 8% Asian, and 2% Native American), 39% did not speak English, 79% were unemployed, 73% were uninsured, and 35% were married. Among the patients with forgotten stents, 68% were male, 64% were minorities (32% Latino, 29% Black, 4% Native American, and 0% Asian), 82% were unemployed, 39% did not speak English, 93% were uninsured, and 43% were married. Multivariate regression analysis demonstrated that uninsured patients (odds ratio [OR], 6.3; 95% confidence interval [CI], 1.4–28.2; *P* value 0.01) and males (OR, 2.8; CI, 1.2–6.8; *P*=0.02) had statistically significant associations with forgotten stents. Men were 2.8 times more likely to have forgotten stents than females. Patients without health insurance were six times more likely to have forgotten stents than patients with insurance. As efforts are made to prevent forgotten stents, increased attention should be given to these higher-risk patient populations.

Introduction

URETERAL STENT PLACEMENT is a commonly used method for upper urinary tract drainage in urologic practice. Despite its routine use and improvements in technology and materials, ureteral stent placement can be associated with both short- and long-term consequences. Short-term sequelae include pain, hematuria, lower urinary tract symptoms, and stent migration.^{1–4} The long-term sequelae from “forgotten” stents, which include occlusion, encrustation, fragmentation, extrusion, abscess formation, renal failure, and sepsis, carry even greater morbidity and costs.^{5–8}

To date, the majority of the urologic literature has focused on the complex management of these forgotten stents, often with multiple endourologic approaches and necessitating more than one session. Several studies have also evaluated potential preventive measures including paper and electronic stent registers and electronic reminders.⁵ In spite of the potential patient safety, economic, and medico-legal implica-

tions of forgotten stents, no studies have addressed which patients are at highest risk for having forgotten stents. This study is the first to identify potential risk factors that make patients less likely to follow up for stent removal so that we may focus our prevention efforts on these persons.

Materials and Methods

A single-institution retrospective analysis of 187 consecutive patients who had first-time stents placed between January 2010 and December 2010 was performed. Data regarding stent placement were obtained from the operative log book, which provides details on every case performed in the main operating room. The log book templates not only require documentation of the procedure performed, but also require specific documentation regarding stent placement.

After identifying all patients with stents placed over this period, a retrospective chart review was performed to see if patients had a stent removed in a timely fashion or had a stent

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removed beyond the intended maximal stent life (MSL) of 6 months. Forgotten stents were defined as stents that were not removed before the MSL. All patients received stents with a MSL of 6 months, and all patients were given clinic follow-up appointments within 3 months of their procedure. Follow-up dates were written in the discharge paperwork. All patients received verbal communication regarding the stent placement, and none was given written information regarding the stent.

Patients who were lost to follow-up and did not have data in the chart indicating whether their stent was removed were contacted via telephone to determine if stents were, in fact, overdue. Patients who could not be contacted were then excluded from the analysis. Data extracted from the chart included diagnosis, age, marital status, sex, employment status, language, race, citizenship status, and insurance status. Statistical analysis was performed on demographic data using SAS 9.2 (Cary, NC) to determine potential risk factors.

Results

Of the 187 patients who had a stent placed over the study period, 147 followed up and had the stent removed before MSL and 28 had forgotten stents that were removed after the MSL. The remaining 12 patients could not be contacted and were excluded from the analysis. Among patients with forgotten stents, the average time that stents remained indwelling was 17 months, with a minimum indwelling time of 7 months and a maximum time of 34 months. Chart review identified that none of the patients with forgotten stents were purposely scheduled for stent removal or exchange at intervals greater than 6 months.

Within our cohort of 175 patients, 48% were males. Married patients accounted for 35% of the cohort while 49% were single and the remaining 16% were divorced, separated, or widowed. Minority groups, including Blacks (30%), Latinos (33%), Asians (8%), and Native Americans (2%), accounted for 73% of the cohort while Whites made up the remaining 27%. Further analysis of demographic data revealed that 39% of the cohort did not speak English, 79% were unemployed, and 73% were uninsured. Private insurance was held by only 3% of the population, and Medicaid (5%) and Medicare (19%) accounted for the remaining 24%.

A total of 28 (16%) patients had forgotten stents. Among patients with forgotten stents, 82% were unemployed. The rate of forgotten stents among unemployed patients was 17% compared with 14% in the employed group. Uninsured patients accounted for 93% of forgotten stents and had a 20% rate of forgotten stents compared with a 3% rate for Medicaid patients and 12.5% for Medicare patients. No patients in our cohort with private insurance had forgotten stents.

Among citizens, there was a 13% incidence of forgotten stents compared with 19% seen among noncitizens. Both English and non-English speakers had equal rates of forgotten stents (16%). Racial comparison identified that 21% of Whites had stents in place beyond MSL compared with 15% for Blacks and Latinos. Also, 23% of males had overdue stents while only 10% of females had overdue stents.

Data analysis was performed to determine correlations between outcome variables. This analysis revealed a correlation between citizens and ability to speak English. No correlation was identified between employment status and insurance status. Bivariate analysis was performed using chi-square and Fisher

TABLE 1. BIVARIATE ANALYSIS: RISK FACTORS ASSOCIATED WITH URETERAL STENT RETENTION

	Forgotten n=28 n (%)	Not forgotten n=147 n (%)	P value
Diagnosis			
Stone	24 (19)	105 (81)	0.1596
Ureteral stricture	1 (5)	21 (95)	0.2087
External compression	3 (18)	14 (82)	0.7383
Minority (Black/Latino)	17 (15)	93 (85)	0.4088
Male	19 (23)	65 (77)	0.0217
Age <40 years old	12 (23)	41 (77)	0.1220
Age 40–54 years old	11 (16)	57 (84)	1.0000
Married	12 (20)	80 (49)	0.3324
English	17 (16)	90 (84)	0.9595
U.S. Citizen	11 (13)	76 (87)	0.2285
Employed	5 (14)	31 (86)	0.6983
Insured	2 (4)	46 (96)	0.0097

exact test, and these results are depicted in Table 1. Male sex and insurance status were significantly associated with forgotten stents while other variables, including ability to speak English and employment status, did not demonstrate any association.

Before performing multivariable regression analysis, interactions between all possible combinations of patient characteristics were assessed, and none were found to be statistically significant, thereby indicating no significant collinearity between variables. On multivariate regression analysis, as outlined in Table 2, insured patients (odds ratio [OR], 0.165; 95% confidence interval [CI], 0.034–0.795; *P* value 0.025) and males (OR, 2.94; CI, 1.122–7.712; *P*=0.028) showed statistically significant associations with forgotten stents. Patients with insurance were 84% less likely to have a forgotten stent when compared with uninsured patients, and men were 2.9 times more likely to have a forgotten stent *vs* females.

Discussion

Forgotten stents pose a considerable threat to patient safety and have significant consequences for healthcare economics as well. In one series of 22 forgotten stents left *in situ* for greater than 6 months (mean of 22.7 months), Monga and associates⁹ found that 68% were calcified, 45% were fragmented, and 14% were calcified and fragmented. In that series, 52% of forgotten stents needed ureteroscopy, 26%

TABLE 2. MULTIVARIATE ANALYSIS: ASSOCIATIONS OF PATIENT SOCIODEMOGRAPHICS WITH FORGOTTEN URETERAL STENTS

	Odds ratio	95% Confidence interval	P value
Minority (Black/Latino)	1.125	(0.412–3.074)	0.818
Male	2.942	(1.122–7.712)	0.028
Age <54 years old	0.569	(0.218–1.488)	0.250
Married	1.753	(0.667–4.609)	0.254
English	1.489	(0.528–4.197)	0.451
U.S. citizen	0.633	(0.228–1.757)	0.38
Employed	0.548	(0.176–1.703)	0.298
Insured	0.165	(0.034–0.795)	0.025

percutaneous nephroscopy, 19% cystoscopic electrohydraulic lithotripsy, 32% extracorporeal shockwave lithotripsy, 3% open cystolitholapaxy, and 3% simple nephrectomy to remove the forgotten stent. Multiple procedures were required in 19% of patients. This was supported by a small series of severely encrusted stents, in which Borboroglu and Kane¹⁰ demonstrated that patients needed an average of 4.2 endourologic approaches to become stent-free and stone-free.¹⁰ In addition, Bultitude and colleagues¹¹ demonstrated in their cohort of 41 patients that 42.8% had developed encrustation at 4 months and 75.5% at 6 months, and on average, 1.94 procedures were needed to remove the encrusted stent.

Thus far, the majority of the urologic literature has focused on management algorithms and treatment techniques. A small subset of the literature has addressed prevention of this costly phenomenon through the use of paper and electronic stent registers. Tang and coworkers¹² reported on their paper stent card register and determined that based on their 5-year retrospective review, their current stent card tracking system was ineffective. They noted that the stent register was time consuming to update and, thus, was infrequently reviewed, thereby resulting in failure to flag 62 of the 203 patients who had stents placed. In addition, they reported a 5.9% failure to capture rate.

Computer-based stent registers such as those reported by McCahy and Ramsden¹³ and Ather and associates¹⁴ demonstrated reductions in retained stents from 3.6% to 1.1% and 12.5% to 1.2%, respectively. These systems, however, like paper systems, relied on manual data entry and manual review and recall to succeed and, thus, they could succumb to the same human errors. Such errors include failure to capture into the database and failure to review the database as well as loss or damage of the database, and inaccurate entry. Lynch and colleagues¹⁵ developed a more robust electronic stent register with stent-extraction reminder facility to limit the system's dependence on human data entry and interrogation. Despite its significant improvements over previously outlined registers, however, a 13% failure to capture rate was still observed. Thus, while more robust stent registers have demonstrated some benefit in reducing the number of forgotten stents, significant room for improvement still exists.

Medicolegally, most believe the surgeon to be responsible for care of the patient after placement of any implantable device, including ureteral stents. Therefore, the surgeon may be responsible for the potential complications of forgotten stents if satisfactory efforts are not made to recall and remove these devices. Unfortunately, as demonstrated with the stent registers, relying on the surgeon alone will not completely prevent forgotten stents. Patients must share in the responsibility of ensuring that stents are removed in a timely fashion. By providing patients with information regarding their treatment and indwelling stent, as has been done in other specialties with implant cards, they can be encouraged to play an active role in their treatment and tracking their stent.¹⁶

Providing patients with the appropriate and required information may also be challenging, however, as revealed by Joshi and colleagues¹⁷ in 2001, when they reported that 80% of patients were dissatisfied about the information they had received regarding their ureteral stent. They also noted that 85% of patients preferred information to be provided in written format with illustrative drawings. The same study developed a validated patient-information booklet on ureteral stents.

While little data exist in regard to factors affecting compliance with stent instructions, a large number of studies have questioned medical therapy compliance. In 2008, Jin and coworkers¹⁸ performed a meta-analysis to identify reasons for therapeutic noncompliance. The analysis reviewed 102 studies performed between 1970 and 2005, which evaluated potential factors resulting in noncompliance with medical therapy. Review of the literature identified that age less than 40 and between 40 and 54 were risk factors for poor compliance. Caucasians exhibited increased compliance, but minority status showed no effect on compliance. Education level and marital status had no effect on compliance with medical therapy. Sex also had no effect on compliance with medical therapy.

This was contrary to what was identified in our study, where males were at increased risk of having forgotten stents. Interestingly, 47% of males with forgotten stents were married, suggesting that having an involved female did not reduce the risk of having a forgotten stent for males. Because this is a retrospective review, however, it is difficult to determine what percent of spouses were present at the time of stent placement and were truly involved.

Finally, decreased accessibility to healthcare was identified as a factor resulting in decreased compliance with medical therapy. Our study supported this finding by demonstrating that insured patients were more likely to have their stents removed in a timely fashion. Patient access to healthcare and financial reasons undoubtedly play a significant role in this finding; however, at our institution, patient financial data are routinely evaluated to determine payment plans and fee waivers as needed and, thus, the explanation is likely more complicated. Unfortunately, because this was a retrospective review, patients could not be queried to obtain more information. Furthermore, it is unlikely that physician bias played any role because there are no incentives to treat insured patients differently than uninsured patients.

The 16% rate of forgotten stents seen in our study was higher than other reported studies listed previously. Based on the analysis, this higher rate may be attributed to the fact that a large portion of our patient population lacks insurance. In addition, during the study period, no preventive measures had been implemented to avoid forgotten stents. Although data regarding stent placement were being gathered, a lack of divisional manpower prevented frequent review of this data and did not allow for patients to be contacted in a timely fashion for removal of indwelling stents.

Implementation of multiple safeguards simultaneously may be more effective than using any single method. Use of a stent registry in addition to providing all patients with written information regarding stents and providing patients with some visual reminder such as an ankle or wrist bracelet with their follow up appointment listed will address the problem on multiple fronts. In addition, use of external stent tethers for patients to remove the stents on their own may be beneficial for patients who clinically meet such criteria and who are at increased risk of having a forgotten stent.

This study represents the first to evaluate potential risk factors for forgotten stents. There were limitations to this study, however. This was a retrospective study and, as such, relied on the accuracy of data entered into the chart in the past. Patients were not questioned directly regarding why stents were forgotten. Furthermore, because several patients were lost to follow-up, there is potential for some bias. In addition,

the cohort of patients analyzed was small, and only variables that were documented could be assessed; thus, potentially significant risk factors could have been left out of the analysis. Finally, because this was a single-institution review, the homogeneity of our cohort may make widespread generalization of findings more challenging. As continued efforts are made to further reduce forgotten stents, prospective evaluations of the effectiveness of various prevention methods should be evaluated and patients with forgotten stents should be queried to determine why the stent was not removed at the appropriate time.

Prevention of forgotten stents will need the efforts of all involved parties. This study identifies patients who are at increased risk of having forgotten stents. Understanding which patients are at higher risk for forgotten stents can help physicians focus additional efforts, documentation, and time toward these persons. Both males and uninsured patients are at increased risk of having forgotten stents based on the multivariate regression analysis. Interestingly, this study also identifies that unemployed patients and patients who do not speak English are not at increased risk when compared with their counterparts. In addition, there is no racial predilection to forgotten stents. As continued endeavors are made to prevent forgotten stents, knowledge of who may be more likely to forget their stent can be used to tailor safeguards and to focus attention toward these patients, especially in situations where stent registers and information booklet may not be available.

Conclusions

Ureteral stent placement is routinely used in urologic practice, but can be associated with significant complications. These complications are even greater in patients with forgotten stents, and current prevention methods are not capable of eliminating this problem. Interestingly, variables that intuitively may have been associated with forgotten stents, including employment status and ability to speak English, demonstrated no association with forgotten stents. Our study identifies that men are nearly three times more likely to have forgotten stents than females and patients without insurance are nearly six times more likely to have forgotten stents compared with insured patients. As continued efforts are made to prevent forgotten stents, increased attention should be given to these higher-risk patient populations.

Disclosure Statement

No competing financial interests exist.

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Abbreviations Used

CI = confidence interval
MSL = maximal stent life
OR = odds ratio