

A solution for medical and legal problems arising from forgotten ureteral stents: initial results from a reminder short message service (SMS)

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Abstract The objective of this study was to describe and present the initial results of a computer-based system that tracks ureteral stents and automatically sends a reminder through a short message service (SMS) to both the patient's and the urologist's mobile phones Using an integrated stent register program (SRP) and a stent extraction reminder program (SERP) with an electronic patient record program (EPRP) located within our hospital's computer network. In this system, the demographic data of all of the patients are recorded into the password-protected EPRP. After a stent is inserted, the surgeon enters the details of the operation into the EPRP. The SRP automatically asks the user to define the "optimal stent life (OSL)". The SERP checks the recorded patients daily and sends an SMS reminder to staff and patient when the OSL is reached. The SERP continues to send reminders via the SMS until stent is removed. We analyzed the success of the SMS recall system. A total of 186 patients received stents over an 11-month period. The patients in group-2 ($n = 108$) were recalled by the SERP, and the remainder of the patients ($n = 78$, group-1) were not included in the project. The mean delay from the designated OSL to the time of stent removal was 307 ± 118.6 (72–1,344) and

14.6 ± 2.06 (5–36) h in groups 1 and 2, respectively ($p < 0.0001$). Our initial results showed that the SRP and SERP prevent stent removal from being forgotten, thus preventing related medical and legal problems.

Keywords Forgotten ureteral stents · Reminder message · Solution · SMS · Complications

Abbreviations

SMS	Short message service
D-J	Double-J
OSL	Optimal stent life
MSL	Maximal stent life
EPRP	Electronic patient record program
SRP	Stent register program
SERP	Stent extraction reminder program

Introduction

Ureteral stents are used to prevent or relieve ureteral obstructions and ensure urinary drainage and diversion. These stents are indispensable components of the urological armamentarium. While ureteral stents have several advantages, forgotten stents are a challenge for even the most experienced endourologists. Forgotten stents can result in serious morbidity, mortality, and an increased financial burden for health economies. Therefore, the treatment of the patients with implanted stents should be considered unfinished until the stent is removed, and these patients should be closely monitored. The attending surgeon is responsible for closely monitoring these patients.

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A number of approaches have been proposed to resolve this healthcare problem, but none have resolved this issue completely [1–3]. Previously proposed approaches have monitored patients with implanted ureteral stents using file records or computer databases [1, 2]. In the most recently proposed system, the patients were monitored with a relevant program that reminded the staff of the due date of the stent removal via e-mails in case the date was forgotten [3]. However, in the system we developed, the patients are monitored with a program that is integrated with the hospital network, and the system sends a short reminder message to both the patient's and the urologist's mobile phones if the optimal stent removal time is exceeded. Thus, the possibility of surgeon negligence is eliminated.

This study presents information about the SMS system, which, presumably, will resolve the problems arising from forgotten stents, and the initial results of this study.

Materials and Methods

In all of the hospitals in Turkey including the hospital that we discuss here, the contact information (home phone numbers, mobile phone numbers, and addresses) of the patients are entered into an electronic patient record program (EPRP), which is connected to a universal network, when the patients are first admitted. This information is updated each time the patient is seen at the hospital. In addition, the personal contact information of all of the staff physicians in the hospital is entered into this network in case of an emergency.

In our country, healthcare organizations are required to document and enter both the contact information and the interventional procedures performed on patients into a computerized database in detail using previously established numerical codes to claim medical and paramedical expenses from health insurance companies. Thus, all of the patients seeking treatment at any healthcare organization and those treated with relevant invasive and non-invasive procedures are registered.

For instance, when a patient goes to a hospital to receive a stent, all of his/her information is entered into the EPRP, a personal file is opened, and all of the procedures performed on him/her are recorded by the attending physician. This system can be utilized in all of the sections of the hospital and is password protected. In addition, this system is assessed daily by the secretary in charge of the department to prevent the lack of capture. This healthcare program has allowed us to establish and implement a short message delivery program.

A stent register program (SRP) was developed to monitor patients with stents implanted via the EPRP. This

program was integrated into the EPRP. The SRP is activated and a box asking for the optimal stent life (OSL) is opened following the stent insertion once the physician enters the code "stent insertion" into the "surgical interventions" section of the patient's file in the EPRP. Unless the OSL is entered in this box, further recording is blocked. Therefore, for each stented patient, the OSL must be recorded before the file can be closed. If the surgeon decides to postpone the stent removal after the evaluation of the patient in the outpatient clinic, the OSL can be restored by the surgeon. Another integrated program called the stent extraction reminder program (SERP) monitors the patients that are entered into the SRP. The SERP automatically sends short reminder messages to the patients' cell phones if the stent removal time is exceeded and suggests that they consult their attending physicians to extract their stents. This program also sends automatic short messages to the physician who performed the procedure warning him/her that the OSL of his/her patient is overdue and asks whether the patient has returned for a control visit. The SERP is routinely activated daily and sends warning messages to the patients whose stents need to be removed, and the surgeons who inserted them. When the surgeon opens the patient's file after the stent is removed and enters "stent removal" into the "surgical interventions" box, the SERP automatically stops sending messages (Fig. 1).

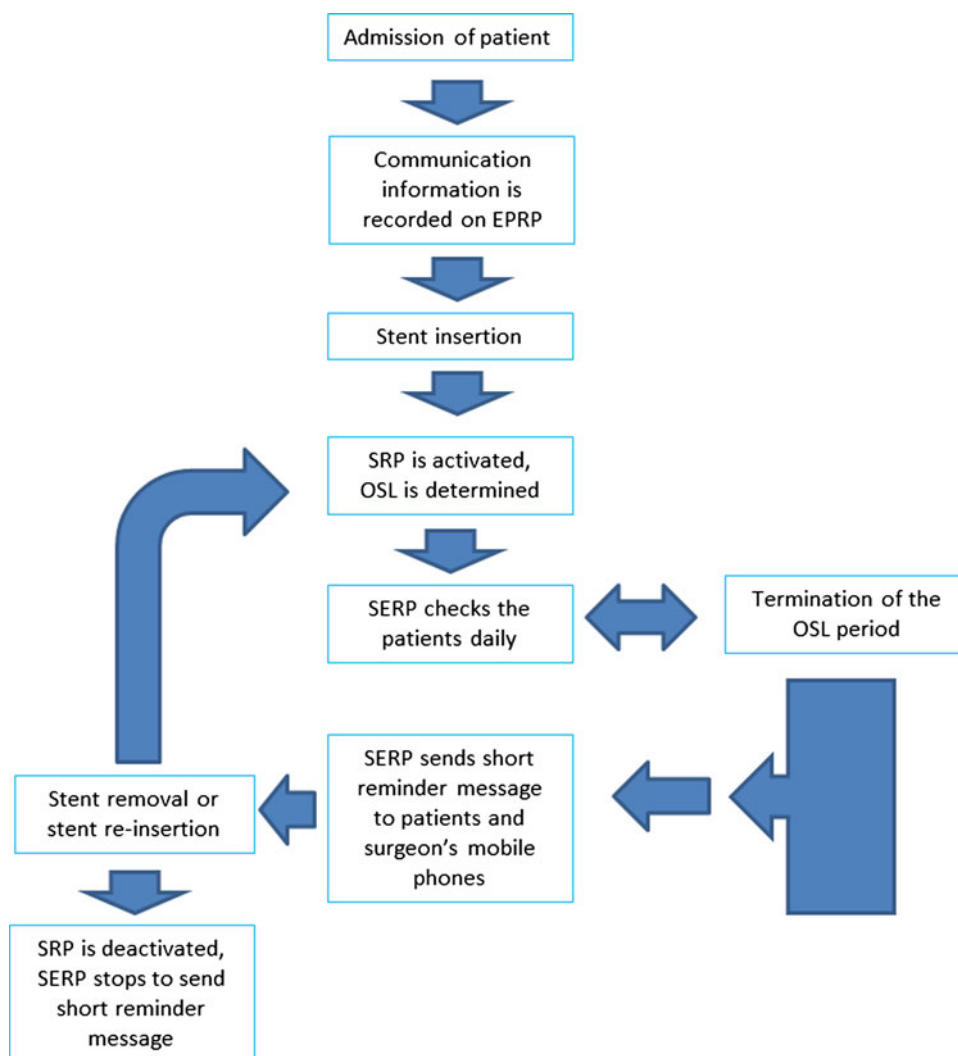
This system was integrated into our hospital's EPRP and is currently in use. This system can be easily integrated to any hospital's electronic patient record program. The patients who underwent stent implantation in the first 4 months of 2010 (group-1) and those who received stents between May and November 2010 (group-2) were retrospectively analyzed to evaluate the success of the system. Before being discharged from the hospital, the patients in group-1 were given an epicrisis indicating the OSL and the stent removal time with a patient information form. In addition, stent removal was verbally discussed with the patients. The time from the OSL to the stent removal was also recorded.

The results are provided as mean values \pm standard deviation. The data were processed using SPSS-13 for Windows (SPSS, Inc., Chicago, IL, USA). A statistical analysis of the means of the continuous variables was performed using Student's *t* test; differences resulting in values of $p < 0.05$ were considered to be statistically significant.

Results

Between January and November 2010, a total of 186 patients underwent ureteral double-J (DJ) stent

Fig. 1 A summary of the processes involved in the SRP and SERP



implantations for a number of reasons. Seventy-eight of these patients (group-1) were verbally warned that they should return to have their stents removed after the OSL was exceeded. Between May and November 2010, the SERP sent automatic messages to the patients with implanted DJ stents whose OSLs were exceeded, and all of the stented patients were logged in the database.

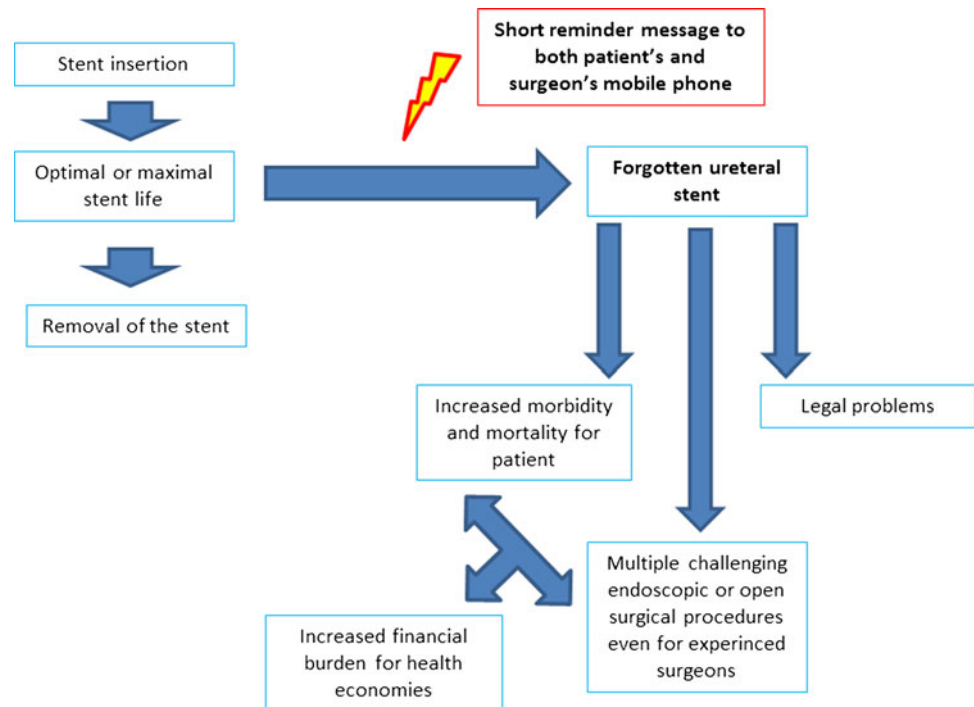
The patients in group-1 were referred to our hospital an average of 307 ± 118.6 (72–1,344) h later than the pre-specified OSL. The patients in group-2 delayed stent extraction for a mean of 14.6 ± 2.06 (5–36) h after the predetermined OSL ($p < 0.0001$). Only 5 (6.4%) patients were admitted to the hospital on the second day after the OSL. So a total of 83 SMS were sent to the patients to remind the stent removal. During this short follow-up period, no incidences of forgotten ureteral stents were encountered. Thirty-three patients (42.3%) who did not own a cell phone provided the phone numbers of their close relatives. Fifty-four stented patients (29%) complained of stent-related dysuria, microscopic hematuria, and flank

pain. These did not cause serious problems that necessitated the removal of the stent before the OSL.

Discussion

Since the introduction of DJ ureteral stents in 1978, the improvements in their configuration and biomaterials have made these stents one of the main components of the urologic armamentarium [4]. The frequent use of stents is associated with inconsistencies in patient follow-up, with delayed stent removal resulting in higher morbidity and mortality [5] (Fig. 2). Thus far, various methods have been employed to avoid problems that are encountered while monitoring stented patients or related to forgotten ureteral stents. Thomas et al. used ureteric stent logbooks to monitor patients with stent implants. However, recognizing the inadequacy of this system, the authors recommended using a new system that included a patient education leaflet and a stent removal date that was planned prior to his/her

Fig. 2 A normal ureteral stent insertion and removal diagram showing the consequences of overdue stents. The reminder SMS system prevents the occurrence of forgotten ureteral stents



discharge from the hospital [6]. Tang et al. [7] retrospectively analyzed patients who had received stents within the previous 5 years and emphasized that their specific stent card tracking systems were ineffective during monitoring because of infrequent revisions and difficulties in updating the system. The failure of these systems was attributed to the fundamental problem of human negligence when registering patients, while the importance of successfully applying computerized systems that minimize human error was also emphasized.

The first computerized ureteral stent retrieval system was developed by McCahy and Ramsden [1]. In this system, the operating surgeon completes a simple form at the time of stent insertion and determines a due date for stent removal. This information is logged into the database by a supervising secretary. A monthly program review enables overdue stents to be tracked. Because of the implementation of this system, the incidence of delayed stent removal decreased from 3.6 to 1.1%. The reasons for the failure of this system include the surgeon's neglect when completing the form and performing stent insertion after the normal operation time or in other clinics. In the system used by Ather et al. [2], the staff enters information concerning patients with implanted DJ stents into computerized files in the operation theater. A urology team is then designated to check the computer reports on a weekly basis to identify the patients whose stents will be overdue in the following 2 weeks. The patients were then contacted by letter or phone. When this system was implemented, the incidence of retained

stents decreased from 12.5 to 1.2%. Even if the patients were entered into a computerized database in both systems, the overdue stents were reviewed, and the patients were recalled by interrogations at 2- or 4-week intervals. The reliability and earnestness of the team checking this system affect the success rates of these systems.

Finally, Lynch et al. [3] designed a stent extraction reminder facility (SERF) that sends email reminders to the physicians when the maximal stent life (MSL) is reached. This system also monitors patients who have received stents with the aid of an electronic stent register (ESR) program that is activated in a hospital network called an electronic patient record (EPR). Under this system, the SERF queries the ESP daily and sends e-mail reminders to the clinician in charge when the stent retention time reaches the MSL. Message delivery continues until the completion and closure of the stent removal. In this system, the process by which the clinician enters the stent insertion data into the ESR program is called the "capture". Under this system, non-capture rates of 39% have been reported. Using barcode technology, capture rates significantly increased from 61 to 87%. Our system resembles that of Lynch et al. In our country, the patient information from all of the healthcare organizations is completely registered, and the registry system is controlled at various stages of the process for a long time, such that the possibility of non-capture is reduced to zero. After the patients are registered by the staff, a dedicated secretary checks the data, and a hospital accountant performs the final control if there is any possibility of negligence.

A study by Lynch et al. [3] defined the maximal stent life (MSL). The MSL was designed to be the date at which the patient should be brought to the urologist's attention if that patient still had a stent in situ. However, in the present study, we predicted possible delays in patient referral for the stent removal and the time span in which the patient might receive the maximum benefit from the stent was defined as the optimal stent life (OSL). Although the possibility of delayed stent removal was predicted beforehand, the mean delay in group-2 was calculated to be 14.6 h. These delay times were 20.89 days and 5.6 weeks in the studies by Lynch et al., and McCahy and Ramsden, respectively [1, 3]. Short messages urged the patients to consult their physicians to have their stents removed. This system has been found to trigger a so-called "conditional reflex".

In 2009, an investigation performed by the GFK research company released a news bulletin stated that, in the previous month, the global frequency of Internet use was 63% (95% in Europe), but Internet use remained low (38%) in Turkey [8]. These lower rates of Internet use are a limiting factor for web-based studies performed in the healthcare sector both around the world and in Turkey. The web-based investigation conducted by Lynch et al. is very reasonable. But Internet use is not prevalent in our country, particularly in our region, and, consequently, web-based studies might not be effective. However, the same study demonstrated that at least one cell phone is used by nearly all residents in Turkey, just as in Europe and in other regions around the world (92%). Even in Turkey, the number of messages sent via cell phones was found to be higher than the number sent in other regions of the world, including Europe. So we think that SMS facilitates communication both to the patient and to the physician.

In the system used by Lynch et al. [3], e-mail reminders are sent to the doctors. In this system, all of the responsibility is with the attending surgeon. Tang et al. [7] emphasized that the patients must assume an active role in the monitoring and management of their stents. In our system, short reminder messages and information are sent to both patients and physicians. Our method appears to have a striking advantage over other comparable systems.

The literature has indicated that the liability for forgotten stents belongs to the attending physician [2]. Similar to legislation in other countries; heavy financial and moral sanctions are imposed for iatrogenic negligence in our country. Nowadays, the awareness of patient rights is continually increasing. It is likely that, in the future, urologists will have to face litigation in response to forgotten stents. Our repeated warning short message system, which includes patient information, could protect urologists from lawsuits filed against them. SMS operating companies can document short messages sent to mobile phones, which

could constitute evidence that defends against the claims of a patient blaming the physician for providing inadequate information.

In the medical literature, the use of SMS has become increasingly popular in the recent years. More than 100 publications describing the use of SMS are currently cited in the medical literature. Many clinicians are orienting their therapies with short messages sent to appropriate patient groups, especially patients suffering from chronic diseases. In the literature, short messages were reportedly used to improve treatment compliance in diabetes [9], asthma [10], malaria [11], alcoholism [12], smoking addiction [13] and sunscreen use [14]. To our knowledge, despite the increasingly widespread use of SMS, SMS reminders and warning systems have not been used in the field of urology to date. Our study is the first study in the urologic literature to use SMS reminders, which could likely solve many chronic problems that arise in urological practice.

Nevertheless, this message system might not reach all patients, due to the inability to obtain the mobile phone numbers of some patients, erroneous phone numbers, phone numbers that were recorded incorrectly during patient admission, phone numbers that had changed, phone numbers that were closed to SMS, and phones left in places or on settings in which messages could not be received. All of these are major limiting factors of our study.

Conclusions

In the present era of technology and advanced communication techniques, the SRP used in the present study to register stents, along with SERPs and reminder short message systems to monitor patients, offer promising means of avoiding the problems associated with forgotten stents. In the future, it is advantageous for patients to use SMS and multimedia message service (MMS). Patients requiring long-term or closer follow-up will be monitored using computer-assisted programs. Our study is the first urological application of its kind and can be used to call back patients with bladder and prostate carcinomas for control visits.

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