

# Use of ureteric stent related mobile phone application (UROSTENTZ App) in COVID-19 for improving patient communication and safety: a prospective pilot study from a university hospital

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**Introduction** During the COVID-19 led lockdown, a reliable system to monitor ureteral stent insertion and timely removal became an important facet of their use. This study looks at the use of 'Urostantz' smart-phone application (app) for stent procedures and whether it improved patient communication and safety during the lockdown.

**Material and methods** The 'Urostantz' app was used for patients who underwent ureteric stent after ureteroscopy (URS) or percutaneous nephrolithotomy (PCNL) procedure. It is a smartphone app developed to improve patient safety, facilitate data collection, and provide an efficient interface to simplify ureteral stent tracking and patient communication. It also helps clinicians track stent-related symptoms (SRS) and provide digital remote assistance.

**Results** A total of 33 patients registered with a mean age of 47.8 years (range:18–80) and a male: female ratio of 4.5:1. Of these, 29 (87.9%) used the Urostantz app, and 55.2% had SRS. The number of effective communication episodes ranged from 1–7/patient. Based on the symptoms and communication, stent was removed during lockdown (n = 2), within 1 week of lockdown lifted (n = 24) and within 2 weeks of lockdown lifted (n = 5). None of the patients suffered any stent-related complications and there were no cases of forgotten stents or readmissions despite the lockdown and lack of communication using standard practices.

**Conclusions** The Urostantz app proved to an effective medium of communication to provide guidance and personalized digital remote healthcare. It also allowed prompt removal of stents avoiding prolonged stent symptoms or forgotten stents. Such apps can have a much wider application in the post-COVID-19-era to reduce unnecessary post-procedural visits and reduce health care costs.

**Key Words:** stent ↔ apps ↔ mobile applications ↔ stent symptoms ↔ stent complications

## INTRODUCTION

The COVID-19 pandemic has brought unprecedented challenges to providing urologic care. To mini-

mize transmission risk, urologists worldwide have decreased both operative and outpatient activity by up to 10–20% of baseline levels [1, 2, 3]. As the need for urological care has not diminished, novel

approaches and innovative strategies are needed to aid the delivery of care [4, 5]. While some endourological procedures such as small renal stones could be delayed and dealt with electively, urgent management of ureteric stones and stents was still needed to mollify and reduce the risks associated with it [6, 7, 8].

During the COVID-19 led lockdown period, utilizing and maintaining a reliable system to monitor ureteral stent insertion and timely removal became an important facet of their use. With the common usage of intra ureteric stents in urological practice, the risk of complications from stent associated infections, stent-related readmissions and forgotten or retained ureteral stents also increased during this period. A delay in stent removal leads to an increase in the anxiety and psychological burden, and we also anticipated apprehension and disquiet due to stent-related symptoms (SRS) in these patients.

To better mitigate and manage the spread of coronavirus, smartphone applications (apps) can prove to be a potential medium to provide personalized digital remote assistance. Such apps can improve the efficiency of the medical system through communication and by replacing a proportion of physical treatments with digital technologies [5]. One such application for ureteric stent management is the Urostentz App, which provides an easy and simplified medium for tracking ureteral stents as well as monitoring SRS [9]. It can also help patients with communication access to clinicians for seeking advice on SRS, complications, and stent removal. Furthermore, the app allows clinicians to reassure the patients regarding any delay in their scheduled date of stent removal and provide digital remote assistance in dealing with SRS.

We used the 'Urostentz' app for all patients who underwent a ureteric stent after ureteroscopy (URS) or percutaneous nephrolithotomy (PCNL) procedure between 1<sup>st</sup> March – 23<sup>rd</sup> March, 2020 (pre-lockdown). This study aimed to look at the use of the app for ureteric stent procedures and whether it improved patient communication and safety during the follow-up period which coincided with the nationwide lockdown from 23<sup>rd</sup> March, 2020 due to COVID-19.

## MATERIAL AND METHODS

### Urostentz mobile phone application (app)

'Urostentz' is a smartphone application developed in 2019 (BMZ, MS, NN), to improve patient safety, facilitate data collection, and provide an efficient interface to simplify ureteral stent tracking and patient communication [9]. It is also the first smart-

phone application that helps clinicians to track the SRS of the patients and provide digital remote assistance for the same. It thereby helps in patient education, stent tracking, symptom tracking, automated notifications and change of appointments. The app can be downloaded from the Google Play store and installed on smartphones and also be accessed directly through the web browser on the computer by visiting the website [www.urostentz.com](http://www.urostentz.com).

### Patients

This was a prospective single-center study conducted in our university teaching hospital. Institutional Ethics Committee (IEC: 651/2019) clearance and certificate was obtained for the study. During the lockdown period of 7 weeks from 23<sup>rd</sup> March 2020 – 15<sup>th</sup> May 2020, we used Urostentz application to track and communicate with 33 patients who underwent ureteral stenting following URS or PCNL in the preceding month.

We assessed the usefulness of this application in providing proper information to patients who could not come for stent removal due to the lockdown situation as well as monitor SRS in case they had any. A two-way communication was established via the app between the patient and a member of the endourology team consisting of a consultant (BMZH), two urology residents (MS, SJR) and a trained urology nurse.

### Protocol

Patients who underwent ureteral stenting following URS or PCNL were asked to download the Urostentz app after informed consent. All patients were registered under the endourology team (BMZH, MS, SJR) (Figure 1). Patient information obtained was encrypted and kept secure and the data could only be accessed by the team involved in the study. As per our routine protocol, a ureteric stent is removed after 2–3 weeks of the procedure, but because of lockdown and unavailability of routine communication and transport services, these appointments could not be fulfilled. To avoid apprehension and anxiety amongst patients related to delay in stent removal, we used Urostentz application as a medium of communication to reassure the patients and provide accurate information regarding the same. The exchange of information was in form of notifications and text messages through the application (Figure 2). Each message sent by the clinician/patient and the reply received for the same was counted as one effective communication episode. The patients were counselled about SRS such as frequency, urgency, dysuria, pain abdomen, vomiting, hematuria and fever. With lockdown related delay

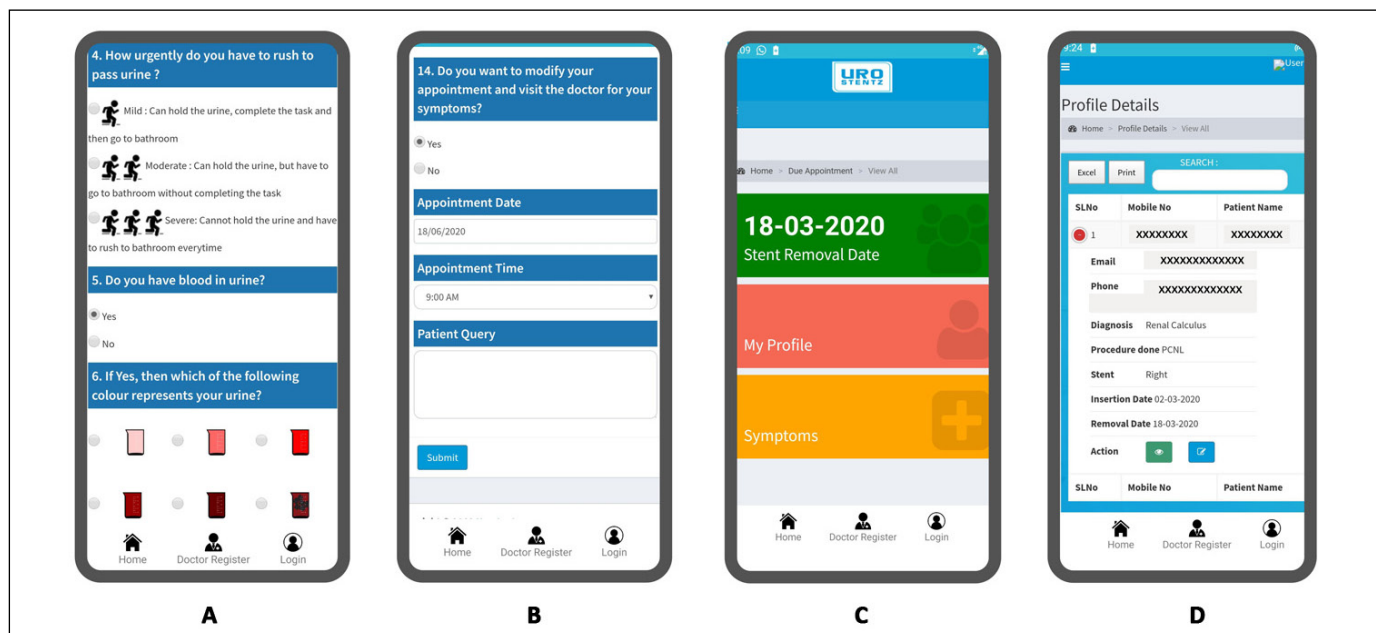


Figure 1. UroStentz app with A. stent symptoms, B. appointment calendar, C. registration page, D. patient details.

in stent removal, we also monitored SRS of the patients through the UroStentz app, in case they had any. The patient could access the pictorial questionnaire and submit details regarding the symptoms to the clinician through the app. As standard communication about stent removal could not be established via telephone, email, or post during the lockdown, we also used the app to inform them about this too.

## RESULTS

The details of patient demographics and the procedures performed are mentioned in Table 1. Of the 33 patients who used the app, 29 (87.9%) used the UroStentz app to contact the team regarding their inability to come for stent removal on the scheduled date, postponement, rescheduling and answered the pictorial symptom questionnaire through the app. The symptom score analysis suggested that 16 (55.2%) patients had SRS and 13 (44.8%) patients had no symptoms.

After careful screening of the patient responses, the team responded to each patient individually using the UroStentz app. The number of effective communication episodes ranged from 1–7 per patient (Figure 3). Of these, 13 (44.8%) had one episode of communication, 12 (41.8%) had 2–4 episodes, and 4 (13.8%) had more than 4 episodes of communication during the lockdown period. Due to severe SRS mentioned in the communication, 2 patients underwent stent removal during the lockdown period. After the lockdown restrictions were lifted and local transport

Table 1. Showing demographics and stent journey of patients using UroStentz App during nationwide COVID-19 lockdown period

Patient demographics	
Age (Mean $\pm$ SD) in years	47.81 $\pm$ 16.11 (range: 18–80)
Male: Female	4.5:1
Right: Left: Bilateral	14:14:5
PCNL: URS	15:18
Stent journey of patient	
Symptom questionnaire answered	29
No symptoms	13 (44.8%)
Symptoms present	16 (55.2%)
No. of communication episodes (range: 1–7)	
1	13 (44.8%)
2–4	12 (41.4%)
>4	4 (13.8%)
Mean stent duration (days)	72 $\pm$ 8.93 (range: 56–96)
Stent removal	
during the lockdown period	2 (6.8%)
within 7 days of lockdown getting lifted	24 (77.4%)
within 7–14 days of lockdown getting lifted	5 (16.1%)
after 14 days of lockdown getting lifted	2 (6.4%)
Complications (UTI, encrustation, readmission)	Nil

SD – standard deviation; PCNL – percutaneous nephrolithotomy; URS – ureteroscopy; UTI – urinary tract infection

facilities were started, the team individually notified and communicated with all patients through the UroStentz app to visit the hospital for stent removal. Four (12.1%) patients who initially did not make contact through the app were followed up through telephonic calls and asked to come for their stent

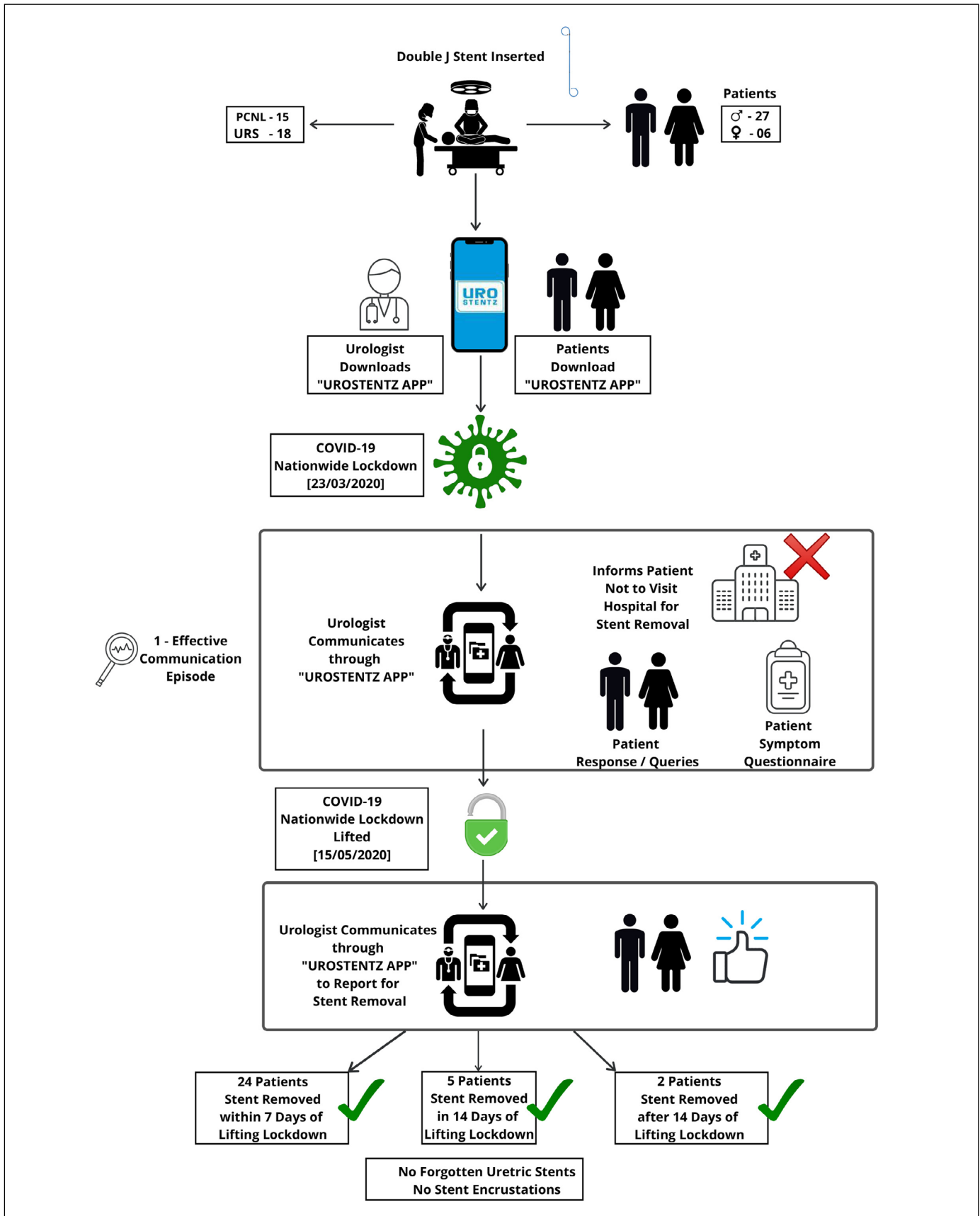


Figure 2. Stent journey of patients using 'UroStentz'.

removal. Stent removal was done within 1 week of the lockdown being lifted for 24 (77.4%) patients and within 2 weeks for 5 (16.1%) patients (Figure 2). As per protocol, X-ray KUB (for radiopaque stones) and ultrasound (for radiolucent stones) was done for all patients before stent removal to check for residual fragments. All stents were removed cystoscopically under local anaesthesia. The mean stent duration was 72 +8.93 days (range: 56–96 days). None of the patients suffered any stent-related complications (UTI, encrustation, readmission) during this period and there were no cases of forgotten stents or readmissions despite the lockdown and lack of communication using standard practices.

## DISCUSSION

### Meaning of our study

Our pilot study shows that smartphone apps are an easy and effective means of monitoring and managing with patients having indwelling ureteral stents. It also provides a medium for effective two-way communication between the patient and their treating clinical team. The use of apps not only allowed management of SRS thereby avoiding stent complications but also allowed the stent removal in a mutually convenient time without the risk of ‘forgotten stents’.

### Need for effective communication during COVID-19

Communication is one of the most important aspects of doctor-patient relationships. Issues in communication between patients and health care professionals (HCPs) and within the health care team itself are a known risk factor of preventable patient harm [1]. Therefore, appropriate communication is key for adequate patient safety and satisfaction. Additionally, aside from the quality of clinical management, the appropriateness of communication has an overall impact on clinical outcomes and care [6]. Due to COVID-19, the burden on the healthcare system to provide proper care, avoid virus transmission, and triaging urgent procedures has been overwhelming. Several urology societies and reference centers have published recommendations on urology care during the COVID-19 pandemic. Keeping this in mind, various guidelines suggest deferring routine procedures [7]. The stent indwelling time should be a factor considered in the prioritization process, keeping in mind that they are prone to infections, obstruction, and encrustations besides affecting the patient's quality of life due to SRS [10]. According to the literature, 12% of all stents remain indwelling beyond their maximal safe life or their duration of intended use. Such

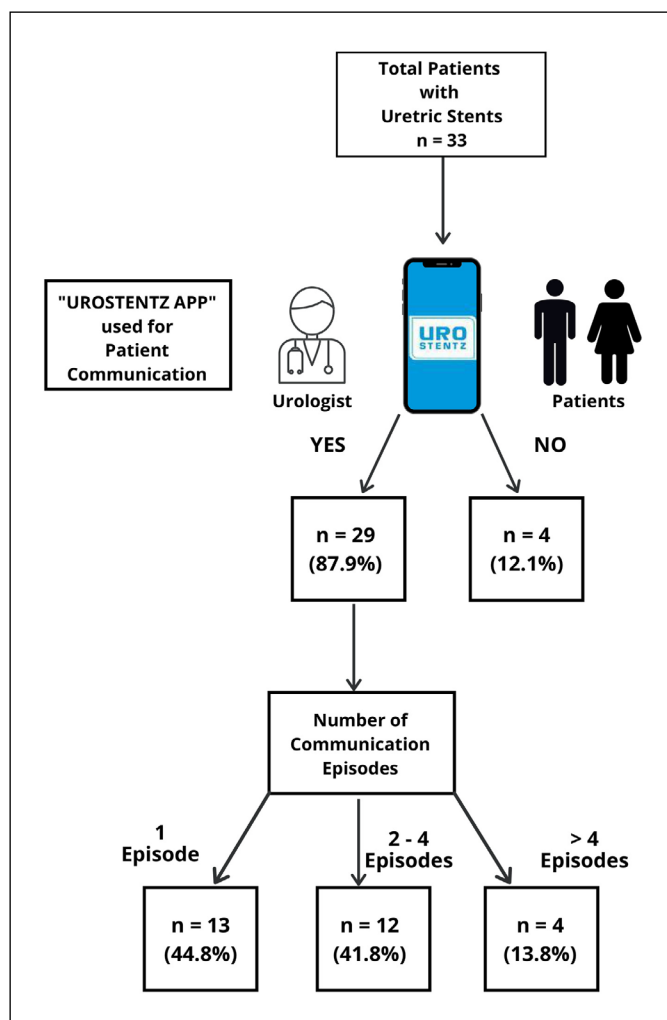


Figure 3. Communication using 'Urorentz' App.

stents are termed as forgotten reteral stents (FUS). FUS can be associated with complications such as infection, migration, encrustation, renal failure, stent fracture and sepsis [11]. More than 75% of stents are found to be encrusted when removed after 12 weeks of insertion [12]. Additionally, nearly 80% of patients experience stent-related symptoms such as loin pain, dysuria, urinary incontinence, haematuria and lower urinary tract symptoms (LUTS) [13]. Besides the additional cost due to medications, hospital visits, procedures, hospital admissions and medico-legal problems, management and removal of encrusted or infected FUS may require combined multiple endourological procedures [14].

The removal of FUS may pose a real challenge to the urologists. It is also associated with increased post-procedure related events (PREs) including phone calls, clinic appointments, and emergency department visits. This adds to increased physical, psychological and economic burden on the patients and

healthcare providers. To avoid this, effective communication between the clinicians and patients is of utmost importance [15]. It is already proven that patients feel more secure when they take a more active part in their healthcare decisions, which in turn increases their adherence to care plans, decreases anxiety, improves clinical outcomes, and reduces healthcare costs [15]. In today's era where most patients use a smartphone, the mobile phone app appears to be the most effective medium of direct patient communication. In our study, 29 patients (87.9%) used smartphone apps for communication suggesting the acceptability of the same.

### Use of smartphone applications for patient communication in post COVID-19 era

One of the biggest strengths of smartphone-based communication is that it overcomes geographical, temporal, and organizational barriers. The other advantages being easy to use, scalability and decrease in healthcare costs [16]. It has also been successfully used for clinical guidance in rural areas of developing countries [17]. It can help reduce anxiety amongst patients due to delay in stent removal as well as decrease health care costs by avoiding unnecessary hospital visits.

### Strengths, limitations and future directions

The use of mobile phone apps allowed communication even during the lockdown when all other forms of communication were ineffective due to a lack of functioning hospital infrastructure. An app-based system of communication can allow patient-reported outcomes, satisfaction, feedback and early intervention in case of any clinical problems. In our study, 2 patients who had severe SRS were called for early stent removal. Although this pilot study proved good uptake of the Urostentz app, the number of patients included in our study was small. Similarly, this may not work for those patients without smartphones or where apps are not available in the local language. The study was conducted at a single-center, so the acceptability of the application across different healthcare institutions is still to be studied.

In future, we can expect smartphone apps to become an integral part of patient care protocol and pathways. Also with the advances in artificial intelligence, there is tremendous scope for research and collaborations tiding on the wave of big data which can be funnelled through these smartphone-based apps.

### CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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