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The Use of Telemedicine for the Postoperative Urologic Care of Children: Results of a Pilot Program

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Abstract:

Purpose: For postoperative visits, which are often brief interactions between family and clinician, patients may prefer the convenience of receiving postoperative care from home. We aimed to evaluate the feasibility of telemedicine for postoperative encounters in pediatric urology.

Materials and Methods: A prospective telemedicine pilot study was conducted during an implementation period from 11/10/17 to 3/22/18. All postoperative patients deemed eligible by one of four urologists were offered enrollment in the telemedicine program. Enrollees underwent at least one virtual visit within six weeks of surgery. Technical difficulties and the number of unscheduled visits and readmissions were noted. After each virtual evaluation, the family and clinician were prompted to complete a survey pertaining to their perceptions of the telemedicine experience, including how effective the virtual visit was in delivering care. For each virtual visit with a urologist, roundtrip travel cost and time were estimated.

Results: There was 96% technical success with utilization of the software. 125 postoperative virtual visits were completed in 83 patients. The median age of children was 3.4 years and 87% were boys. Clinicians found that the virtual visit was “very effective” in 86% of cases, delivering the same care that they would have provided during an in-person visit. Families were estimated to have saved a mean of \$150 of travel cost and a median of 113 minutes of travel time per visit. No adverse postoperative outcomes were observed.

Conclusion: This pilot study demonstrates that telemedicine can be successfully implemented in the postoperative care of pediatric urology patients.

Keywords: telemedicine, virtual visit, postoperative care, pediatric urology

Introduction:

Telemedicine, the remote delivery of health care services and clinical information using telecommunications technology, provides an array of innovations that may improve patient-centered medical care [1]. While telemedicine was developed to treat patients located remotely, it is increasingly employed as a tool for convenient medical care even among local patient populations. This novel technology affords the opportunity to deliver surgical expertise in a timely manner for patients [2-4].

Pediatric urologic care is primarily provided at academic medical centers, compelling many families to travel long distances for specialized care. Such travel is associated with significant direct costs in the form of transportation, accommodations, and meals. There are also opportunity costs to the family, including missed school for the child and missed work for parents. For major procedures or initial surgical consultations, such costs may be perceived as reasonable. However, for postoperative visits, which are often brief interactions between family and clinician, the costs may be out of proportion to the perceived benefits of the visit [5-7]. For this reason, telemedicine may be particularly valuable in the postoperative setting.

Telemedicine offers a digital modality for care that would have been received in-person. In a telemedicine “virtual visit”, a patient and clinician are directly connected via a secure, live, interactive video system. The patient can connect from any convenient location using a mobile device or computer. In virtual visits, both verbal and non-verbal communication as well as visual

wound assessment is possible. Thus, this new modality provides appropriate and timely care in a location conveniently accessible by both the patient and provider.

Within pediatrics, telemedicine may carry additional benefits for families, who are spared the inconvenience and potential lost income caused by travel away from home. Minimizing the burden of travel may be particularly important in children with special needs and/or complex medical issues. However, there has not been widespread adoption of telemedicine by pediatric surgical specialties [6, 8]. A PubMed literature search for “pediatric urology telemedicine” or “pediatric urology telehealth” in July 2018 yielded eight manuscripts in English, of which only four addressed utilizing telemedicine in a clinical setting involving pediatric general surgical (two) or urological (two) patients [9-12]. Only one of these studies specifically focused on the postoperative urologic care of children [10].

In this pilot study we sought to assess the feasibility of virtual visits for postoperative encounters in pediatric urology. We hypothesized that at least 90% of scheduled virtual visits would be successfully completed. To our knowledge, this is the largest evaluation of telemedicine for postoperative pediatric urologic care.

Materials and Methods:

We conducted a prospective study of the implementation of telemedicine within the Department of Urology at a single institution from November 10, 2017 until March 22, 2018. Study exemption was obtained from the institutional review board. All postoperative patients who did not require an in-person postoperative examination were deemed eligible and offered enrollment in the telemedicine program. For this pilot study, only English-speaking families were recruited, although English did not need to be their primary language.

Four urologists as well as five registered nurses (RNs) were trained to pilot the telemedicine platform. Ideally, enrollees underwent a virtual visit with a RN 24 to 72 hours after surgery and then with a urologist at one to six weeks after surgery. Although not all payers currently cover virtual visits, issues of billing compliance were mitigated by selecting a postoperative population, as postoperative visits occurring during the “global period” after surgery incur no professional charges. For arranging the actual telemedicine capability, the institution has a contract with a third party vendor of the software platform. There was minimal direct cost to the department; most desktops and personal laptops already had a webcam so only a few simple hardware purchases were made (total expenditure of \$126).

Patients’ families who elected virtual postoperative follow-up were given an educational pamphlet and downloaded HIPAA-compliant video-conferencing software, provided free of charge. The software connects to providers via Wi-Fi or cellular connection, and patients can use any mobile device or computer (with operating system Windows 7 and above, Android 4 and above, iOS 7.1 and above, or Mac 10.10 and above) that has a webcam. If a postoperative radiologic study was required, patients were scheduled to obtain the appropriate imaging study at the nearest satellite location or local medical facility. Providers documented their virtual visits within our electronic medical record. These evaluations include assessment of activity level, bladder and bowel function, pain scores, and appearance of any surgical incisions.

The primary outcome was feasibility. The focus was on implementation, defined as the extent to which the telemedicine program could be successfully delivered to participants. As such, any technical problems were documented. Appointment status metrics, including the number of completed and no-show visits, were tracked. The following variables of interest were also recorded: virtual waiting room time and visit duration as well as the number of unscheduled

clinic or emergency department visits, surgical complications, and readmissions. When the family signs in to the video conference prior to the scheduled visit time, they enter the virtual waiting room. The virtual waiting room time is recorded as the time from when the patient enters this virtual waiting room until the provider joins the appointment. For each roundtrip visit with a urologist, travel cost and time were estimated using Google Maps © based on the average mileage and time from each patient's geographic location to the main hospital site and to the closest satellite by time (see Supplemental Table for cost assumptions). This range of estimates best reflects our practice, since not all patients are able to be seen at the closest satellite based on provider availability. The travel estimation was recorded for a Wednesday at noon, not taking into account unusual traffic conditions or the time spent parking.

A secondary outcome was the family and clinician assessment of the encounter. After each virtual visit, the family and clinician were prompted to complete an anonymous electronic survey pertaining to their perceptions of the telemedicine experience (see Supplemental Figures I & II). These surveys were developed by the Digital Health team and are used across the institution for all telemedicine encounters.

Results:

During the initial three months of the telemedicine pilot program (11/10/17 to 1/31/18), 64% of postoperative patients were identified as eligible. Ultimately, during the study period, 138 virtual visits were scheduled for 91 patients. Six scheduled patients were a "no show" for eight virtual visit appointments (four with a urologist) for unknown reasons - a 94% (130/138) rate of compliance. There were technical issues in five additional virtual visits, yielding a 96% (125/130) rate of technical success with utilization of the telemedicine software. Two families had technical issues that prevented their virtual visit from occurring. Providers also had difficulty with the software in three visits and alternative conferencing software was used in these instances.

Overall, there were 125 completed postoperative virtual visits (using the intended platform) in 83 patients. Two-thirds of patients had both a virtual visit with a RN and a urologist. The median age of children in this study was 3.4 years (IQR 1.1 to 8.6), ranging from two months to 23 years. Forty-six percent of patients were aged two years or younger. Eighty-seven percent of patients were boys. Enrollees had a variety of surgeries, with circumcision and hernia or hydrocele repair being the most common (see Table I).

Seventy-seven percent of families used a mobile device for the encounter. No additional family members conferenced in from other devices. The median virtual waiting room time was 5.0 minutes (IQR 3.0-11.5) and the median appointment duration was 7.1 minutes (IQR 4.4-10.1). Providers documented that inspection of the postoperative incision was possible in all patients (who had a surgical incision). Remote examination was feasible in all cases of scrotal orchidopexy. For stoma revisions, the provider guided the guardian through the process of removing the patient's catheter and catheterizing the new stoma. When patients had postoperative imaging, the provider shared his screen with the family for discussion of the radiologic findings.

Our patients were mostly regional. The estimated median travel distance and time avoided to the main hospital was 64 miles (IQR 31-102) and 113 minutes (IQR 76-148) roundtrip. If an appointment were available at the closest satellite location, the estimated median travel distance and time avoided would be 35 miles (IQR 15-74) and 64 minutes (IQR 37-108)

roundtrip. We estimated that families saved a mean of \$150 or \$140 of travel cost to the main hospital or closest satellite, respectively.

The survey response rate was 26% and 77% for families and providers, respectively. The mean family and provider satisfaction with the virtual visit experience overall was 9.8 and 9.1 (out of 10), respectively (see Table II). Eighty-six percent of clinicians found that the virtual visit was “very effective” in delivering the same care that they would have provided during an in-person visit.

Within 30 days of surgery, no patient presented for an unscheduled encounter. One parent of a patient who had undergone ureteral reimplantation expressed concern about a urinary tract infection during their virtual visit and this child was brought into clinic to give a urine specimen. There were no readmissions.

Discussion:

Despite the demonstrated efficacy of telemedicine among other specialties [13, 14] and in adult urology [4, 15, 16], its applicability within an outpatient pediatric urologic patient population is mostly unknown. Only one other children’s center in the United States has published on their telemedicine experience - this was a small study on the postoperative urologic care of ten children [10]. Here we report on our experience with 125 virtual visits in 83 postoperative patients with a median age of 3.4 years old.

In our experience, the in-person postoperative assessment by the urologist is a brief encounter that promotes quality and satisfaction but also incurs disproportionately large direct expenditure as well as opportunity costs for families. Our results confirm that the duration of a postoperative visit can be short - a median of 7 minutes in this study. For this brief visit, families were estimated to have avoided an average of \$150 of direct expenses and almost two hours of travel burden. This likely represents an underestimate of actual travel time avoided, since our estimate does not take into account “rush hour” traffic or the time needed to find parking and so forth.

Basic telemedicine tools, such as laptops, tablets, and mobile smartphones, have become more readily available to patients. As such, a growing number of patients can access telemedicine as a means for convenient and efficient medical care. Although others have reported on using telemedicine to permit patients at a local healthcare facility to communicate with providers at a remote facility, there are limited studies evaluating its use with patients at home [10, 12, 13]. Our platform for virtual visits allowed patients and their families to communicate directly from their home or any other convenient location. This may be particularly important in the care of complex children, for whom even transportation to a local facility may be burdensome and expensive. For instance, in at least one instance of stoma revision, the patient was wheelchair-dependent and arranging an in-person postoperative visit or virtual visit from a satellite location would have required a substantial cost and effort. In addition, this type of innovative patient encounter may allow families to avoid making alternative plans for other children. Avoiding travel to and from a remote healthcare facility may also minimize time away from work and school for family members and the patient, respectively. These potential benefits may drive improved family satisfaction.

We did observe a favorable compliance rate with our postoperative telemedicine program. This may be, at least in part, due to the convenience of performing the encounter from home, as discussed above. Notably, more than two-thirds of families used mobile phones for

their virtual visit encounter. Regardless of the device used, there was high technical success with utilization of the telemedicine software.

Virtual visits do have limitations. When a telemedicine visit is performed with a patient at a satellite location, a medical assistant can help with the physical exam and report feedback. However, this is not the case when the encounter occurs from a family's home. Our clinicians noted that, particularly with the mobile devices, the video can appear in constant motion if the camera is not stabilized. Families may also require some direction in order to adequately display the child's incision. In particular, for scrotal cases like orchidopexy, the family must be comfortable examining their child and the provider must be comfortable with that assessment.

Nevertheless, we found that remote physical exam was possible in a wide age range of patients who underwent a number of surgical procedures. The majority of providers found that the virtual visit was "very effective" in delivering the same care that they would have provided during an in-person postoperative visit. There did not appear to be any delays in diagnosis or adverse outcomes because of the lack of an in-person postoperative clinic visit.

Furthermore, virtual visits were employed in some patients who required postoperative radiologic evaluation. These patients were able to undergo imaging studies at a convenient time and location, with the imaging then being shared and discussed virtually with the patient/family. Creative use of this technology can drive improvement in health care quality and increase accessibility.

There are limitations of this pilot study. The study design is not a randomized controlled trial. Therefore, it is possible that selection bias or other unmeasured factors may account for some of the results. It is likely that those families who felt more comfortable with electronic devices were more inclined to participate in the telemedicine program. We also realize that some families do not have the appropriate electronic devices or Internet access to utilize virtual visits. In addition, since this was a pilot study, there was no control group, which prevents the comparison of this intervention to conventional postoperative care. A study is underway to compare the telemedicine experience to that of a similar patient population undergoing in-person follow up. Finally, we were unable to draw significant conclusions for family satisfaction given the low survey response rate. Completion of the electronic survey is voluntary and families are able to exit their virtual visit experience prior to submission of the survey. When the survey is completed, it is done so anonymously, prohibiting a comparison of the characteristics of those families who responded to the survey and those who did not. It is necessary to explore the postoperative use of telemedicine in a larger systematic framework and efforts will be made to improve the family survey response rate.

Conclusions:

This pilot study demonstrates that telemedicine can be successfully implemented in the postoperative care of pediatric urology patients. Use of this innovative technology was feasible and reduced the travel burden for families. As the number of patients with access to electronic devices capable of telemedicine continues to grow, it will be important to incorporate postoperative follow-up with telemedicine into practice.

Conflict of Interest Statement: There is no conflict of interest.

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Ethical Approval: Study protocol determined to be exempt by the institutional review board (IRB-P00028048).

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Table 1. Baseline characteristics

Patient Characteristics	(N=83)
Median Age (IQR)	3.4 years (1.1-8.6)
Sex: Male (%)	72 (86.7%)
Female (%)	11 (13.3%)
Surgical Procedure	Number of Patients
Circumcision/ Circumcision Revision	35
Hydrocele/Hernia Repair	14
Scrotal Orchiopexy	8
Ureteral Reimplant	7
Small Penile Procedures (i.e. Lysis of Adhesions)	5
Stoma Revision	4
Stone Procedures	3
Orchiectomy	3
Hypospadias Repair	2
Labioplasty	1
Laparoscopic Procedure	1

Table 2. Results of a postoperative telemedicine pilot program.

Operational Characteristics		(N=125 Virtual Visits)
Median Virtual Wait Room Time (IQR)		5.0 minutes (3.0-11.5)
Median Virtual Visit Duration (IQR)		7.1 minutes (4.4-10.1)
Rate of Successful Remote Examination		100%
Clinical Outcomes		
Unscheduled Encounters		0
Readmissions		0
Survey Responses		
Family		(N=33)
Mean Satisfaction Score (1-10)		9.8
If virtual visit had not been available, would have received care via (%):		
In-person visit at institution		30 (91.0)
In-person visit at another healthcare facility		1 (3.0)
No visit at all		-
Done something else		-
No response		2 (6.0)
Benefits (multiple responses allowed, %)		
Convenience		28 (84.8)
Improved access		21 (63.6)
Efficiency		30 (90.9)
Other (e.g. quality care)		6 (18.2)
Use of Technical Support (%)		2 (6.0)
Provider		(N=96)
Mean Satisfaction Score (1-10)		9.1
Effectiveness in Care Delivery (%)		
Very effective		82 (85.4)
Somewhat effective		11 (11.5)
Neutral		2 (2.1)
Somewhat ineffective		-
Very ineffective		-
No response		1 (1.0)
Use of Technical Support (%)		7 (7.3)