

Pediatric urology surgical practice in the time of COVID-19: Results from tertiary Saudi Arabia hospitals

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Abstract **Purpose:** Our study aimed to evaluate the effect of COVID-19 on pediatric urology practice in the Kingdom of Saudi Arabia (KSA).

Methods: Data of 10 tertiary hospitals in KSA were retrospectively analyzed. Data of outpatient department (OPD) visits and pediatric urology surgical procedures from January 1, 2019, to April 30, 2019, and from January 1, 2020, to April 30, 2020, were extracted. The primary outcome was to compare OPD visits and pediatric urology workload in the first third of 2020 versus 2019, where there was no curfew. The secondary outcome was to compare the same variables during the full curfew time, i.e., April 2020 versus April 2019.

Results: The number of OPD visits was lower in the first third of 2020 (7390 vs. 10,379 in 2019 $P < 0.001$). OPD visits in April 2020 were 78.6% lower than in April 2019, and teleclinics represented 850 (94.3%). Elective procedures in the first third of 2020 were 688, with a reduction rate of 34.3% compared to the same period of 2019 ($P < 0.001$). In April 2020, there were 18 elective surgeries, with a 91.4% decrease than in April 2019. Ureteric reimplantation, hypospadias, cryptorchidism, and circumcision stopped, while pyeloplasty ($n = 14$) and urolithiasis ($n = 4$) procedures had declined by 50% and 76.5%, respectively. Most of the procedures (71.8%) were day surgery. Emergency procedures were similar in the first third of 2020 (65 vs. 64 in 2019, $P = 0.994$) and declined in April 2020 by 6.7% versus April 2019. During the full curfew, the most common emergency intervention were cases with obstructive uropathy (42.8%), followed by torsion testis (28.6%), posterior urethral valve (14.3%), and urological trauma (14.3%).

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Conclusions: In KSA, the number of elective pediatric surgical procedures were reduced by >90%, while the number of emergency pediatric surgical procedures were similar during COVID-19 pandemic compared with non-COVID-19 time. Ureteric reimplantation, hypospadias repair, cryptorchidism, and circumcision procedures were postponed. Pyeloplasty and urolithiasis-related procedures were performed to prevent irreversible disease progression or organ damage. There was an increase in rate of teleclinic and day surgery to reduce the risk of COVID-19 infection.

Keywords: Coronavirus, COVID-19, pediatric urology, Saudi Arabia

INTRODUCTION

Wuhan city in China was the first city to report coronavirus infection on December 2019.^[1] Then, on March 2020, COVID-19 coronavirus was announced as pandemic affecting countries and territories all over the world. COVID-19 infection is spreading rapidly. By the time of this study, more than 15,930,021 and 641,842 confirmed coronavirus cases and deaths have been reported.^[2] Unfortunately, health-care systems were overwhelmed by this unprecedented event, medical resources such as hospital beds and protective equipment were depleted, in addition, medical decisions and surgical priorities have been changed dramatically. Most of the medical and surgical societies have developed recommendations and different triage systems to guide the decision-making process with special focus on adult patients or pediatric surgery.^[3] Outpatient clinics and elective surgeries were postponed or canceled to preserve hospital resources and to keep hospital beds available for the inevitable surge of COVID-19 patients. Moreover, hospitals updated infection control strategies and provided health-care workers with personal protective equipment (PPE) to guard against COVID-19 infection.^[3]

By July 25, the Kingdom of Saudi Arabia (KSA) reported as many as 262,772 confirmed cases, 215,731 recovered cases, and 2672 deaths.^[2] To control the pandemic and reduce the risk of COVID-19 infection, suspension of the seasonal minor Umrah pilgrimage and closure of mosques in all cities were among other important lockdown measures taken by the KSA government. By March 23 and April 6, partial and full curfews have been decided in KSA, respectively.

COVID-19 in pediatric population is different than adult population regarding infection and mortality rates, as severe COVID-19 in children is rare and infection rate is very low.^[4] In China, a recent review of 72,314 cases showed that the infection rate in children younger than 10 years of age was <1%. Children usually present with mild symptoms or have an asymptomatic course that

resolves within 1–2 weeks, and thus, they could be a silent carrier for COVID-19.^[5] In terms of COVID-19 mortality in children, only two reported deaths occurred in China^[6] and no deaths in Italy^[7] at the time of study writing. In contrast, the adult global mortality rate reached up to 4% of those contracted COVID-19.

In general, urology procedures are emergent, urgent, or nonurgent. Several recommendations and guidelines have been published recently to guide for treatment of adult urology patients.^[8–10] In contrary to adult urology, pediatric urology practice is widely variable and has large disparities between pediatric urologists and pediatric surgeons all over the world.^[11] There is a lack of pediatric urology guidelines that prioritize urological surgeries during COVID-19 pandemic. As pediatric urologists on the front lines, we have postponed most of our elective procedures. Recently, Quaedackers *et al.* presented recommendations for pediatric urological cases according to published studies and expert opinions. They stated that most of the pediatric urological diseases are not urgent and do not require immediate intervention; nevertheless, delay of treatment may have a negative effect of the future fertility or renal function for those children.^[3] However, these recommendations, clinical judgments, and surgical procedures may be affected by several factors including local regulations, available facilities and resources, number of health-care workers, and burden of COVID-19 for each institute and city. Thus, we aimed in the present multicenter study to test how COVID-19 pandemic influences the pediatric urology workload across KSA. So far, literature data in this regard are lacking, and to our knowledge, no study has evaluated this before.

METHODS

This study is a retrospective observational multicenter study. Medical Ethics Committee and the Institutional Review Board at King Saud Medical City and other participating centers have approved the present study. The study dataset consisted of children's records who were treated at outpatient department (OPD) clinics and urology departments of the main tertiary hospitals inside

KSA. Hospitals are distributed in the largest KSA cities including Riyadh, Jeddah, Dammam, and Madinah. These tertiary hospitals receive patients from the surrounding small hospitals and cities.

Data of OPD pediatric visits and pediatric surgical work volume were collected. The total number of OPD visits including teleclinics was extracted. Lists of elective pediatric urology surgeries including pyeloplasty, hypospadias repair, ureteric reimplantation, cryptorchidism, urolithiasis treatment, circumcision, and other procedures were gathered. Similarly, the lists of emergency pediatric urology surgical procedures were retrieved, such as posterior urethral valve (PUV), testicular torsion, urolithiasis treatment, obstructive uropathy, incarcerated hernia, and pyelonephritis. We collected data of the first third of the year 2019, i.e., from January 1 to April 30, and the first third of the year 2020, i.e., from January 1 to April 30.

Study outcome measurements

The primary outcome was to compare OPD visits, number, and types of pediatric urology surgical procedures in the first third of 2020 versus 2019. The secondary outcome was to compare the same variables during the full curfew time, i.e., April 2020 versus April 2019.

Statistical analysis

The absolute number change of OPD visits and surgical procedures was calculated by subtracting the 2019's number

from the 2020's number. The percentage (%) number change of OPD visits and surgical procedures was calculated using the following formula = $([2020\text{'s number} - 2019\text{'s number}] / 2019\text{'s number}) \times 100$. Chi-square test was used to compare between the frequency of OPD visits and elective and emergency pediatric procedures in the first third of the year 2019 versus 2020. All statistical analysis was performed using SPSS version 23 software (IBM SPSS Statistics, IBM Corp., Armonk, NY, USA). $P < 0.05$ was considered statistically significant.

RESULTS

Overall, 17,769 children have visited our OPD. The total number of OPD visits was significantly 28.7% lower in the first third of 2020 (7390 vs. 10,379 in 2019, $P < 0.001$). In March 2020, the OPD visits have decreased by 37.6% compared to the same period of the last year (from 2451 to 1530). The total number of OPD visits in the full curfew period (i.e., April 2020) was 78.6% lower than April 2019 [Table 1 and Figure 1a,b]. Teleclinics performed through telephone calls represented 850 (94.3%), while 51 (5.7%) of children visited the outpatient clinics with their parents.

Overall, 1776 elective pediatric urology surgical procedures were performed. Elective procedures in the first third of 2020 were 688, with a decline rate of 34.3% compared to the first third of 2019 ($P < 0.001$). There were 125 elective surgical procedures in March 2020 compared to 295 in

Table 1: The difference of the outpatient department and pediatric urology workload performed in the first third of the year of 2020 and 2019

Procedure	2019	2020	Total	Absolute change	Percentage change
OPD visits					
January	2989	2503	5492	-486	-16.3
February	2261	2456	4717	195	8.6
March	2451	1530	3981	-921	-37.6
April	2678	901	3579	-1777	-66.4
Total	10,379	7390	17,769	-2989	-28.8
Test of significance (Chi-square test)				$X^2 = 662.385$	
<i>P</i>				$< 0.001^*$	
Elective pediatric surgical procedures					
January	272	280	552	8	2.9
February	243	259	502	16	6.6
March	295	125	420	-170	-57.6
April	278	24	302	-254	-91.4
Total	1088	688	1776	-400	-36.8
Test of significance (Chi-square test)				$X^2 = 203.286$	
<i>P</i>				$< 0.001^*$	
Emergency pediatric surgical procedures					
January	15	15	30	0	0
February	17	18	35	1	5.9
March	18	17	35	-1	-5.6
April	15	14	29	-1	-6.7
Total	65	64	129	-1	-1.5
Test of significance (Chi-square test)				$X^2 = 0.084$	
<i>P</i>				0.994	

OPD: Outpatient department

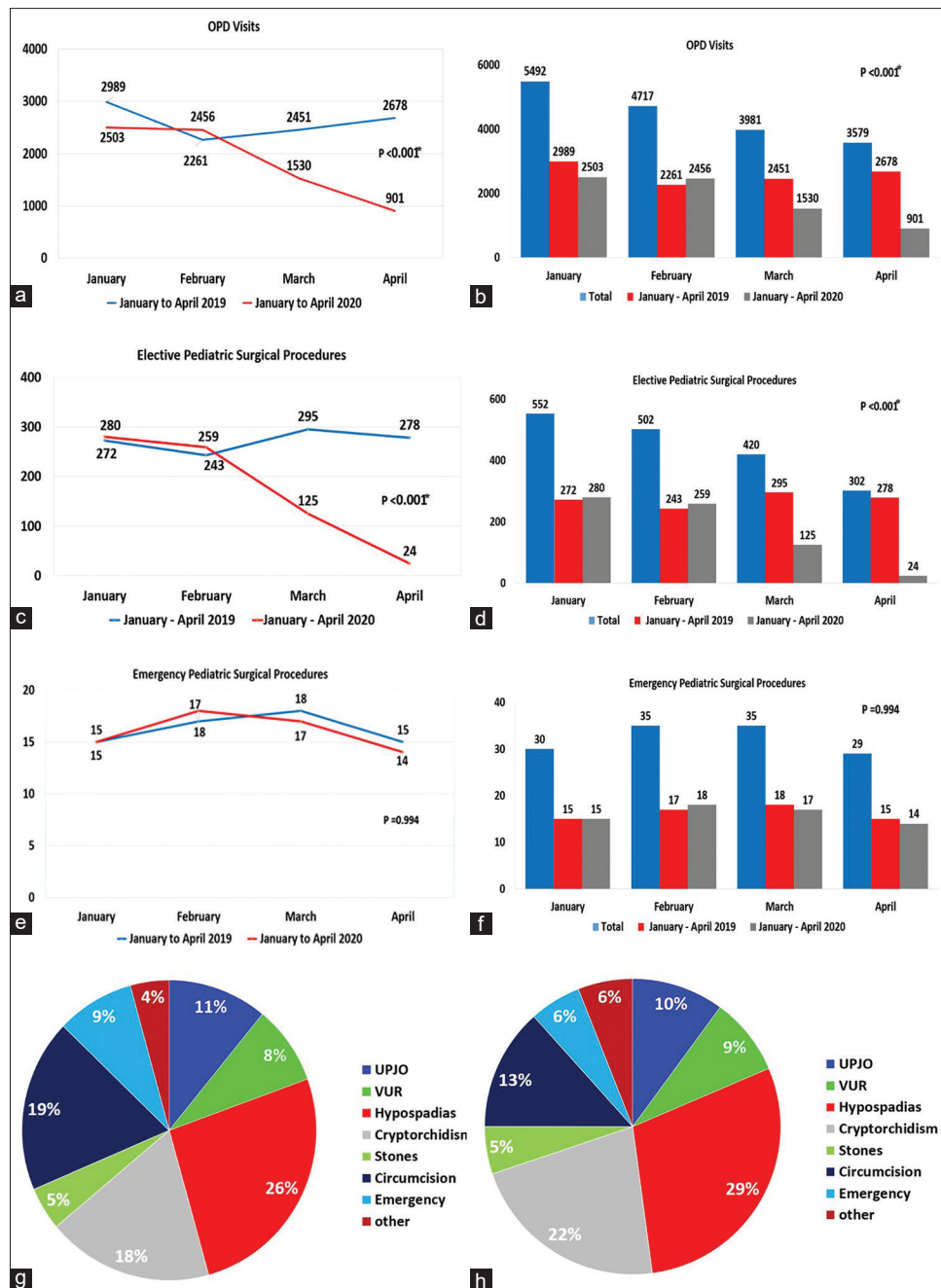


Figure 1: The number of outpatient department visits (a and b), the number of elective pediatric surgical procedures (c and d), the number of emergency pediatric surgical procedures (e and f), the type of pediatric surgical procedures (g and h) in the first third of 2019 and 2020

March 2019, with a 57.6% decrease, while in April 2020, there were 18 elective surgeries, with a marked drop by 91.4% compared to April 2019 [Table 1 and Figure 1c and d]. Indications of elective procedures during the curfew period were renal function decline ($n = 5$), obstruction with infection ($n = 5$), long-standing obstruction ($n = 4$), and persistent symptoms ($n = 4$). The rate of pyeloplasty, hypospadias repair, ureteric reimplantation, cryptorchidism, urolithiasis treatment, circumcision, and other elective procedures in the first third of 2020 versus 2019 was 12%

versus 11%, 29% versus 31%, 9% versus 9%, 20% versus 23%, 5% versus 6%, 20% versus 14%, and 5% versus 6%, respectively [Figure 1g and h, and Figure 2a and b]. During the full curfew period, some procedures such as ureteric reimplantation, hypospadias repair, cryptorchidism surgery, and circumcision had stopped completely compared to the same month of the last year, while other procedures such as pyeloplasty and urolithiasis had declined by 50% and 76.5%, respectively. Most of the surgical procedures 23/32 (71.8%) were performed as day surgery.

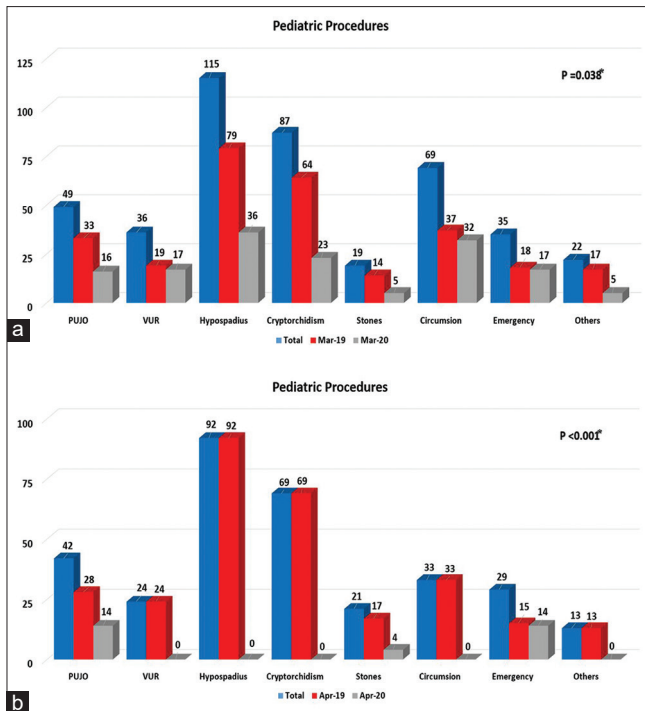


Figure 2: The number of pediatric surgical procedures in March 2019 versus March 2020 (a), and the number of pediatric surgical procedures in April 2019 versus April 2020 (b)

The total number of emergency pediatric urology surgical procedures has decreased in the first third of 2020 by 1.5% (65 vs. 64 in 2019, $P = 0.994$). Emergency procedures in April 2020 declined by 6.7% compared to April 2019 [Table 1 and Figure 1e and f]. There was a slight drop by 5.6% in the number of emergency procedures in March 2020 and by 6.7% in April 2020 compared to the same period of the last year [Table 2]. During the full curfew period, operative emergency cases included the following: urolithiasis and obstructive uropathy (42.8%), torsion testis (28.6%), PUV (14.3%), and trauma (14.3%).

DISCUSSION

KSA is the 13th worldwide and 4th Asian most affected country by COVID-19.^[2] During the pandemic, most of our hospitals have begun to follow up the recently published recommendations and triage systems in all subspecialties, putting into consideration the local resources, facilities, and health-care workers available in each hospital. Our main aim was to prioritize the medical and surgical admissions to preserve PPEs, masks, and other supplies to save our health-care workers and patients, as well as preserve our hospital beds in case of any inevitable surge of COVID-19 patients.

We conducted this study to assess the actual impact of COVID-19 pandemic on pediatric urology surgical practice

in KSA. We analyzed data of 10 tertiary hospitals in the largest four cities in the kingdom. Interestingly, we found that elective pediatric urology procedures have declined by more than 90% during the full curfew time. However, emergency procedures were not reduced during COVID-19 pandemic. Fortunately, most of the pediatric urological diseases do not require urgent or immediate intervention, however, delay in treatment of these diseases may have a future effect on fertility status and renal function.^[3]

As pediatric urologists, we are facing COVID-19 impact every day in our practice. During this unprecedented situation, our clinical decision and surgical practice is not at all simple or a straightforward process. Quaedackers *et al.* classified pediatric urological problems into four stages. For Stages 1 and 2, surgery can be postponed. Conversely, for Stage 3, surgery should be performed as delay will cause irreversible organ damage or disease progression, while for Stage 4, it is an organ-threatening or life-threatening condition where surgery must be performed immediately.^[3]

Our results showed that there was a statistically significant decrease in the number of elective pediatric surgical procedures in the first third of the year 2020 compared to 2019. There was no major difference in January and February 2020, while in March and April 2020, there was a decrease by 37.6% and 78.6% than the same period in the last year, respectively. Certain procedures such as ureteric reimplantation for treatment of VUR, hypospadias repair, cryptorchidism, and circumcision were stopped completely during the curfew time. Of note, these diseases are classified as Stages 1 and 2.^[3] Most of the pediatric urologists believe that a delay in the treatment of hypospadias, hydrocele, low-risk reflux, and cryptorchidism will not harm the child during this unprecedented pandemic, however, for how long we have to postpone these elective procedures, as we do not know how long this pandemic will last.^[11] Delay in hypospadias repair may have an adverse psychological impact on children and may increase the risk of complications. As we know, the ideal time to repair hypospadias is between the age of 6 and 12 months, and the American Academy of Pediatrics recommended that children with hypospadias should be operated before 30 months old.^[12-14] In a recent study, Garnier *et al.* evaluated 501 boys undergoing hypospadias primary repair to determine the outcomes of hypospadias surgery according to age. They found that age >2 years was a significant predictor of complications (odds ratio: 1.98), dyssynergia was more common between the ages of 2 and 3 years, while healing problems were more common in boys aged >13 years.^[15] Early hypospadias repair before the age of 18 months minimizes the potential psychological

Table 2: The difference between the type of pediatric urology surgical procedures performed in the first third of the year of 2020 and 2019

Procedure	Overall	January 2019	January 2020	Absolute change	Percentage change
UPJO	57	30	27	-3	-1
VUR	54	28	26	-2	-7.1
Hypospadias	179	90	89	-1	-1.1
Cryptorchidism	115	58	57	-1	-1.7
Stones	29	18	11	-7	-3.9
Circumcision	86	34	52	18	52.9
Emergency	30	15	15	0	0
Other procedures	30	15	15	0	0
Procedure	Overall	February 2019	February 2020	Absolute change	Percentage change
UPJO	50	25	25	0	0
VUR	48	27	21	-6	-22.2
Hypospadias	149	77	72	-5	-6.5
Cryptorchidism	119	62	57	-5	-8.1
Stones	26	11	15	4	36.4
Circumcision	106	50	56	6	12
Emergency	35	17	18	1	5.9
Other procedures	36	24	12	-12	-50
Procedure	Overall	March 2019	March 2020	Absolute change	Percentage change
UPJO	49	33	16	-17	-52
VUR	36	19	17	-2	-10.5
Hypospadias	115	79	36	-43	-54.4
Cryptorchidism	87	64	23	-41	-64.1
Stones	19	14	5	-9	-64.3
Circumcision	69	37	32	-5	-13.5
Emergency	35	18	17	-1	-5.6
Other procedures	22	17	5	-12	-70.6
Procedure	Overall	April 2019	April 2020	Absolute change	Percentage change
UPJO	42	28	14	-14	-50
VUR	24	24	0	-24	-100
Hypospadias	92	92	0	-92	-100
Cryptorchidism	69	69	0	-69	-100
Stones	21	17	4	-13	-76.5
Circumcision	33	33	0	-33	-100
Emergency	29	15	14	-1	-6.7
Other procedures	13	13	0	-13	-100

UPJO: Ureteropelvic junction obstruction, VUR: Vesicoureteral reflux

damage caused by genital surgery such as rapprochement, stranger anxiety, and separation anxiety.^[16] Orchidopexy for treatment of undescended testes is recommended before the age of 18 months to decrease the risk of future testicular cancer and infertility. During COVID-19 pandemic, postponement of cryptorchidism surgery for few months might not be a problem and should not be delayed more than 6 months.^[11] In a recent population-based cohort study of 350,835 boys, 7499 (2.1%) had been diagnosed with undescended testes. The study showed that for every 6 months of delay in orchidopexy, there was a 1% reduction in paternity, while there was an increase in risk of testicular cancer and need of assisted reproductive technologies by 6% and 5%, respectively.^[17]

On the other hand, our results revealed that pyeloplasty and urolithiasis surgical procedures had declined by 50% and 76.5%, respectively. Both procedures can be classified either nonurgent or urgent, depending on the clinical presentations and risk of renal function compromise. If

ureteropelvic junction obstruction (UPJO) is not associated with loss of differential renal function, and if urinary stones are not associated with infection or obstruction, intervention can be postponed with continuation of essential care and close follow-up. However, if UPJO is associated with progressive loss of differential renal function or severe symptoms, and if stones are associated with infection, urosepsis, long-standing obstruction, or intractable symptoms, intervention should be performed to prevent irreversible disease progression or organ damage or death.^[3] Intervention may be temporary through draining of the obstructed kidney using indwelling JJ stent insertion or nephrostomy tube followed by definitive treatment later. Alternatively, active treatment through pyeloplasty or endoscopic stone intervention can be performed depending on local situation and resources. The decision to operate or postpone surgery in children with obstructive uropathy (e.g., urolithiasis, UPJO, ureterovesical junction obstruction, neurogenic bladder, and PUV) must be revised properly as it may lead to loss of renal function. Delay in

treatment of obstructed kidney, especially if associated with infection, can predispose to severe septic complications and increase the risk of intensive care unit admissions by 15% and mortality rates by 8%.^[18] The exact time of how long the intervention can wait is not known, as the dynamics of renal function loss depends on several unpredictable factors.^[19] For urinary obstruction without infection, time frame of 6–12 weeks to intervene may be suitable, however, if urinary infection exists, intervention is a must to prevent renal function loss.^[11]

During the full curfew period, the most common emergency intervention was for treatment of obstructive uropathy (42.8%), followed by torsion testis (28.6%), PUV (14.3%), and trauma (14.3%). These pathologies are classified as organ-threatening or life-threatening diseases, i.e., Stage 4^[3] or tier 0,^[9] that need immediate intervention. Stensland *et al.* recommended to treat torsion testes and PUV as outpatient procedure during COVID-19 pandemic.^[10]

Of note, OPD visits in April 2020 were 78.6% lower than April 2019. Interestingly, teleclinics performed through telephone calls represented 94.3%, while 5.7% of the children visited the outpatient clinics with their parents. Telemedicine plays an important role in minimizing the risk of infection spread by reducing personnel contact and cross contamination.^[20] In addition, we tried to maintain the highest standard of care to our patients, by reducing the length of hospital stay as much as possible, to reduce the children's risk of contracting COVID-19 during their hospital stay. In our study, 71.8% of the surgical procedures during curfew time were performed as day surgery.

The recently published pediatric urology recommendations are few that can help us prioritize surgical procedures during the COVID-19 pandemic. These recommendations need to be adjusted according to locally available resources, medical staff, and the COVID-19 burden of each institute and city. What is certain is that some children will miss the best time for treatment. These children will face the risk of undesirable consequences, increased psychological pressure, and anxiety. At the end of this unprecedented crisis, they should take priority in the long waiting list.

The main drawback of our research is its retrospective design. Nevertheless, there are several advantages. To our knowledge, this is the first study to assess COVID-19 impact on pediatric urology surgical practice in a country. Moreover, this is a multicenter study involving 10 tertiary KSA hospitals. In addition, the sample size is large, and our analysis includes 17,769 OPD visits and 1776 surgical procedures.

CONCLUSIONS

During the COVID-19 pandemic, elective pediatric urology procedures in KSA tertiary hospitals were reduced by more than 90% compared to the same period of the last year. Some procedures have been completely stopped, such as ureteric reimplantation, hypospadias repair, cryptorchidism, and circumcision, as these procedures are considered nonurgent. On the other hand, pyeloplasty and urolithiasis-related procedures were decreased by 50% and 76.5%, respectively. We performed these procedures to prevent irreversible disease progression or kidney damage. No difference was present in the rate of emergency procedures before or during the COVID-19 pandemic. To reduce the risk of infection and maintain resources, most of the hospitals have adopted new strategic measures, such as telephone clinics and increased day surgery rates. Pediatric urologists should consider the recent recommendations according to surgical priority during treatment of pediatric patients and adjust it according to locally available resources, medical staff, and the COVID-19 burden of each institute and city.

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Conflicts of interest

There are no conflicts of interest.

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