



# Pediatric urology in the era of COVID-19

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Received: 9 December 2020 / Revised: 4 February 2021 / Accepted: 9 February 2021 / Published online: 2 March 2021  
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## Abstract

**Introduction** The coronavirus disease 2019 (COVID-19) has mandated the pediatric urologists to adapt to the changing dynamics and adopt the strategy to minimise the collateral damage. The purpose of this study is to compile all the available literature and published guideline to facilitate the patient management.

**Materials and methods** PubMed, Scopus, and Google scholar database were systematically searched using the search terms “COVID-19” AND “pediatric” AND “urology”. All published papers retrieved from this search were considered for this review based on PRISMA guidelines. In addition to this, World Wide Web search was conducted for guidelines, and recommendations published by scientific societies and their websites were searched for the desired information.

**Results** Total eight articles and society recommendations met the inclusion criteria and included in the study. The general level of agreement was found on need to postpone the elective cases and ensuring the safety of hospital staff. The organ and life-threatening conditions like acute and symptomatic obstructive uropathy and testicular torsion should be treated on an emergent basis irrespective of COVID status. There is no evidence that any modality either open or laparoscopic has any advantage over the other. The protocols need to be modified based on stage of pandemic, availability of resources, and local guidelines. The restart of work once the pandemic is over should also be prioritised.

**Conclusion** There are very few articles and society guidelines on pediatric urology care in the COVID era, but all the available guidelines stress on prioritisation, protocol-based management, and improvisation as per the circumstances.

**Level of evidence** V.

**Keywords** COVID-19 · Pediatric · Recommendations · Urology

## Introduction

The corona virus disease 2019 (COVID-19) was declared a pandemic by the world health organisation on 11 March 2020 [1]. It has turned out to be an international public health emergency leading to significant disruption of public and personal life world over. Various measures like social distancing, use of appropriate personal protective equipment, stringent disinfection protocols and hand-hygiene awareness in general public have apparently resulted in reduction of some of the burden on healthcare system. Even then, the exponential increase in the number of cases has mandated the need to reallocate all resources towards the COVID-19

patients. Diversion of medical resources towards COVID-19, lockdown imposition, and new social distancing norms have forced the healthcare institutions to adapt by making unprecedented changes in the patient care. Telemedicine and reverse telemedicine have become the need of the hour. Triage, prioritisation, and improvisation of the protocols as per the changing dynamics of COVID-19 are being seen all over the world. Multiple guidelines, recommendations, and personal experiences have been published for adult and pediatric patients in various field. The purpose of this systematic review is to compile all the available recommendations and published guidelines in the era of COVID-19 in field of pediatric urology to enable optimal utilisation of the resources without compromising the safety of patients and medical personnel.

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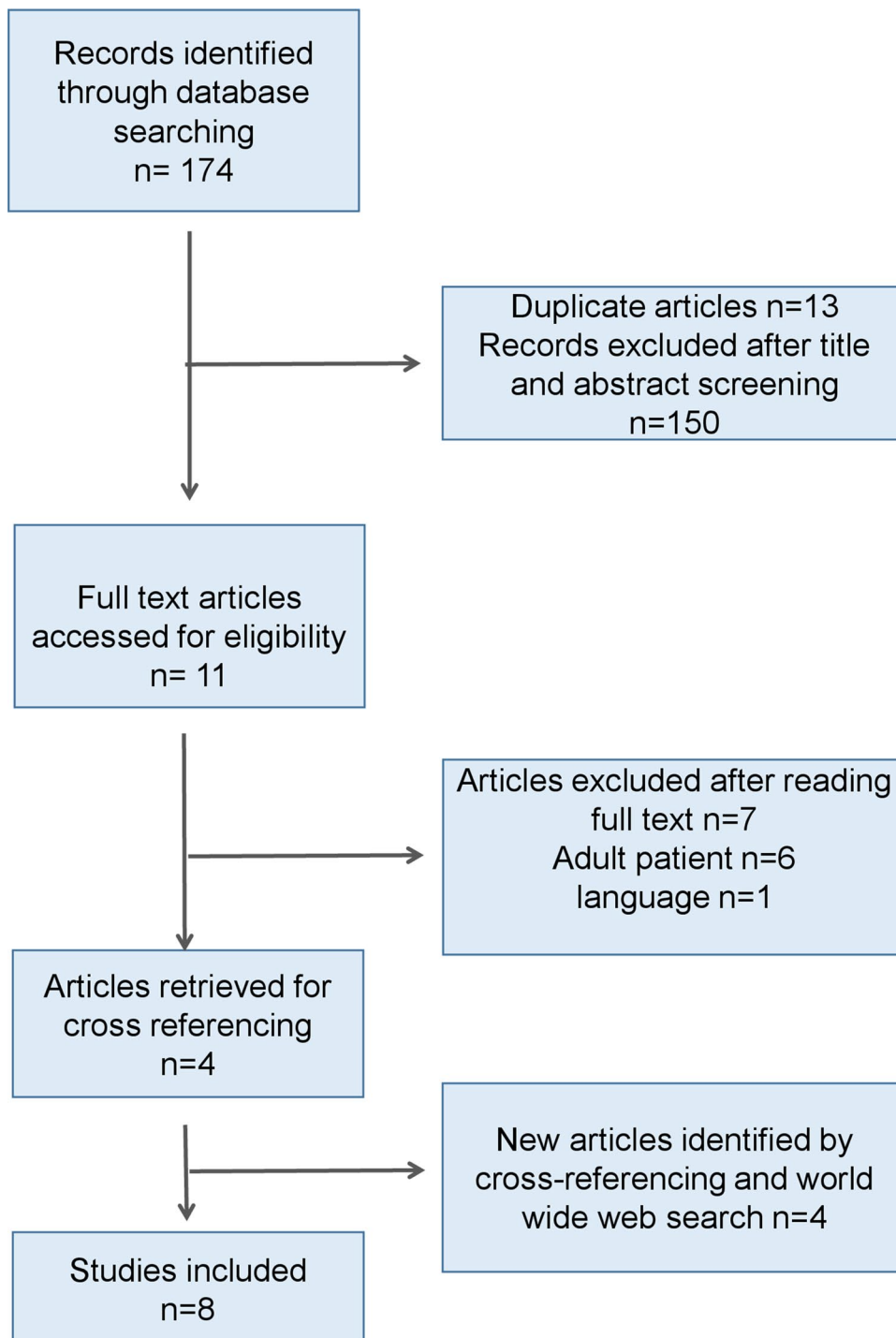
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## Materials and methods

PubMed, Scopus, and Google scholar database were searched. The Medical Subject Headings (MeSH) in combination with the Boolean operators “AND” were used for search. MeSH terms used were “COVID-19” AND “pediatric” AND “urology” for PubMed and Scopus database.

The Google scholar advanced search was done with “COVID-19” filled in “with the exact phrase” section, “Urology” in “with at least one of the words”, and the option “in the title of the article” was selected. The search function was limited to human subjects. All published papers retrieved from this search were considered for this review based on PRISMA guidelines (Fig. 1) [2–9]. Two reviewers independently performed the eligibility

**Fig. 1** PRISMA statement for systematic review of pediatric urology guidelines in COVID era



assessment and data extraction. Screening of the titles and abstracts was done for relevance. After exclusion of the articles as per the exclusion criteria, full-text articles were reviewed. In addition, all the articles and review articles were further cross-referenced for additional articles. In addition to this, World Wide Web search was conducted for guidelines, and recommendations published by scientific societies and their websites were searched for the desired information.

## Eligibility criteria

### Inclusion criteria

1. All publications related to pediatric urology guidelines and articles in relation to COVID-19 pandemic.

### Exclusion criteria

1. Duplicate publications.
2. Non-availability of full text in English.
3. Adult urology papers.

## Data extraction and analysis

Two reviewers independently performed eligibility assessment and data extraction (MP and AS). Any discrepancy was resolved by consensus discussion. The retrieved articles were assessed with regards to prioritisation, protocol for admission, role of telemedicine, minimal invasive surgery protocols, safety of the hospital staff, and management post-COVID-19 peak.

## Results

PubMed, Scopus and Google scholar database search retrieved 174 articles. After title and abstract screening, four articles fulfilled the inclusion criteria. A further four documents regarding recommendation from scientific societies worldwide were identified with web search.

### Prioritisation

This issue was addressed by four society guidelines and three articles [2–4, 7–9]. The consensus has been that all elective surgeries that can be delayed without any risk to the patient should be postponed until the resolution of COVID-19 outbreak. In the guidelines published by Canadian Urological Association (CUA), it was recommended to screen for red flag signs or symptoms [4]. These red flag signs/symptoms were used to determine the patients requiring urgent in-person clinical assessment or urgent surgery. These signs/symptoms were defined for each pediatric urological condition and post-pandemic re-booking priorities were also defined (Tables 1, 2).

British Association of Pediatric Urology (BAPU) [3] has classified the urgency of cases into 5 categories.

1. Can wait for 2 months with no input other than patient query.
2. Can safely wait for 2 months, but will need a virtual check in by phone to ensure they do not come to harm
3. These patients need on-going treatment (infusions/injections), etc. to ensure that their health is maintained.
4. Clinically urgent, need week-by-week assessment, and may need operation within a week.
5. Life and limb threatening, or urgent surgery, need to be admitted and operated urgently.

**Table 1** List of the articles and guidelines included in the systematic review and the issues addressed by each reference

S.no	References	Prioritisation	Post-COVID peak protocol	Minimal invasive surgery issues	Hospital admission protocol	Health care professional safety measures	Management according to the stage of pandemic
1.	ESPU [2]	Yes	No	No	No	No	No
2.	BAPU [3]	Yes	Yes	No	No	No	No
3.	Keefe et al. [4] and CUA	Yes	Yes	No	No	No	No
4.	Spinoit et al. [5]	No	No	No	No	No	No
5.	Fernandez et al. [6]	No	Yes	No	No	No	No
6.	Cini et al.[7]	Yes	Yes	No	Yes	No	No
7.	Esposito et al. [8]	Yes	No	Yes	Yes	Yes	No
8.	Quaedackers et al. [9] and EAU	Yes	Yes	No	No	Yes	Yes

ESPU European Association of Pediatric Urology, BAPU British Association of Pediatric Urology, CUA Canadian Urological Association, EAU European Association of Urology

**Table 2** Red flag signs for different pathologies and post-pandemic re-booking priorities as per the Canadian Urological Association

Pathology	Red flag signs	Urgent re-booking (as soon as possible)	Semi-urgent re-booking (safe to wait up to 3 months)	Non-urgent re-booking (safe to wait up to 6 months)	Elective re-booking (safe to wait beyond 6 months)
Hydronephrosis	Bilateral HDUN ± bladder abnormalities, solitary kidney with severe HN, dysplastic kidneys, symptomatic HN (flank pain, vomiting)	Post-operative follow-ups, new referrals, Previous moderate HN, new infants with UTIs	Stable HN, stable PUV, known VUR patients on chemoprophylaxis	Post-op patients with stable US, older PUV patients with no immediate concerns	
Penile pathology	DSD, paraphimosis, obstructive urinary system, hair tourniquet on the penis, urinary retention, new onset urinary incontinence	Pathological phimosis, non-cosmetic related hypospadias complications	Routine post-op follow-ups	New hypospadias patients, hypospadias patients awaiting second stage	Cosmetic concerns in hypospadias patients
Inguinal pathology	Incarcerated inguinal hernia	Symptomatic inguinal hernias	Suspected inguinal hernia, hydrocele in more than 2 year old child	Hydrocele in less than 2 year old child	Less than 1 year old child with hydrocele
Undescended testis	Bilateral impalpable UDT, Suspected testicular torsion, acute onset varicocele (non-reducible in recumbent position may suggest intraabdominal mass)	Bilateral UDT, impalpable UDT, UDT with hernia, symptomatic varicocele, > 2 year old child with UDT	1–2 year old child with UDT, asymptomatic varicocele, post-op follow-ups	6–12 months with UDT	< 6 months of age with palpable UDT; retractile testis
Bladder/cloacal exstrophy	Newborn with bladder/cloacal exstrophy	Post-op follow-ups, febrile UTIs	Infants under routine surveillance, uncomplicated UTIs	Continence issues	Older patients with routine surveillance
End-stage renal disease	Refractory hypertension or massive proteinuria, palpable mass or suspicious lesion on imaging				
Post-operative patients	Any complication: infection, pain, decreased urine output, requiring procedures like DJ stent removal				

HN hydronephrosis, HDUN hydro-ureteronephrosis, DSD disorders of sexual differentiation, UDT undescended testis

European Society of Pediatric Urology (ESPU) categorizes the cases into low, intermediate, high priority, and emergency group [2]. Low priority is where harm is unlikely and surgery can be deferred by 6 months, e.g., inguinal hernia, hydrocele and undescended testis (UDT). Intermediate priority group needs surgery before end of 3 months, e.g., pyeloplasty if no loss of function, urolithiasis if no infection or obstruction. Pyeloplasty with progressive loss of function or symptoms and PUV come under high priority and need to be operated within 6 weeks. Trauma with hemodynamic instability, urosepsis with obstruction, and testicular torsion are conditions that require immediate surgery.

Cini et al. divided the surgical procedures into three groups [7]; the first is emergent and urgent procedures requiring surgery within few hours or on the same day of diagnosis (testicular torsion, acute renal function impairment, paraphimosis, etc.). The second group includes procedures that should be managed within few days or some weeks (neoplasms and non-symptomatic ureteric obstruction). The third group incorporates all the procedures that should be deferrable until the end of COVID-19 emergency (hernia, hydrocele, undescended testis, hypospadias, bladder exstrophy, etc.)

### Optimal utilisation of telemedicine/virtual visit

Most of the articles and recommendations have stressed on the role of telemedicine in the COVID-19 pandemic. CUA recommends that virtual visit should be arranged in all cases without any red flag signs/symptoms [4]. Virtual encounter involves detailed history taking, previous medical records review, and video calling over a secure connection as and when required. Telemedicine consultation can also be used to order the imaging investigations and lab tests whenever indicated. Another role of the telemedicine is in follow-up patients. The routine follow-up of the patients in the out-patient clinic following surgery should be replaced by virtual visit. The post-operative patients following hernia surgery, orchidopexy, and pelvi-ureteric junction obstruction do not need to physically attend the outpatient department. The physical visit is restricted for the patients developing any complication or needing any intervention like DJ stent removal.

### Protocol for hospital admission

It has been discussed by Cini et al. and Esposito et al. [7, 8]. The patients deemed fit for the in-patient admission for semi-urgent procedures should be accompanied by one parent only, and screening for body temperature and flu-like symptoms (cough, cold, and fever) should be done before admission. It should be accompanied by COVID-19 test and

COVID negative patients without any flu-like symptoms are admitted.

For emergency procedures where patient cannot wait for COVID-19 test results or when COVID test is positive then, these patients are to be admitted in the dedicated COVID ward and surgery is also performed in the dedicated COVID theatre.

### Recommendations according to various stages of COVID-19

EAU proposes guidelines depending upon stage of the pandemic [9]. In stage 1 and 2, the recommendation is to reduce the surgical cases and perform only urgent and semi-urgent cases. Stage 3 perform surgery for cases in which delay will cause *irreversible* progression of disease or organ damage. In stage 4, only life threatening or organ threatening diseases like urosepsis with obstruction, trauma with hemodynamic instability, testicular torsion, etc. should be operated.

### Recommendation for minimal invasive surgery in pediatric urology

As yet, there is no evidence to support either open or laparoscopic surgery modality as an increased or decreased risk over another [10].

Esposito et al. [8] have deliberated upon the role of laparoscopy and robotic surgery in pediatric urology during COVID-19 pandemic. During minimal invasive surgery, the particle concentration of smoke is significantly higher than open surgery. In addition, the risk of exposure to aerosol is also higher due to the air leak from port site, during instrument change and specimen retrieval. Certain measures have been recommended to minimise the risk of exposure to the pneumoperitoneum aerosol.

1. Appropriate skin incision for port placement, so that there is no air leak alongside the port site.
2. Keeping the CO<sub>2</sub> pressure and flow as low as possible without compromising the safe conduction of procedure.
3. Ensuring that the trocar stop cork or leur connectors are closed during the insertion of port to avoid undesired gas leakage.
4. Minimising the use of monopolar/bipolar electrocautery and energy devices. Whenever needed, electrocautery should be used at low-power setting and cutting mode to be preferred over coagulation mode.
5. The use of suction-assisted smoke evacuation device.
6. The Trendelenburg position time should be minimised to reduce its impact on lung function and perfusion thus decreeing the susceptibility to infection.
7. Complete and controlled desufflation of pneumoperitoneum should be done using an adapted suction–evacu-

ation system before specimen retrieval. The specimen may be grasped with a firm grasper before desufflation to facilitate its retrieval. The specimen should preferably be placed in specimen retrieval bag before extraction to avoid exposure with bodily fluids.

### Safety of the hospital staff

Safety of the hospital staff was elaborated by Quaederkers, Esposito et al., and certain measures were recommended to ensure the safety of the medical personnel [8, 9]:

1. Appropriate selection of the patients needing surgery and in-hospital admission.
2. Screening of the patient: All the patients should be screened at the time of admission for flu-like symptoms, fever, and COVID status. These patients should be categorized as per the COVID status to determine the type of ward that patient is admitted in (dedicated COVID ward/general ward).
3. COVID status assessment and screening for flu-like symptoms should be done for the accompanying parent, as well. Only one parent is allowed to accompany the patient.
4. All the room should preferably have single bed per room to avoid cross-infection.
5. Optimal use of personal protective equipments and proper training of the health care personnel should be ensured.
6. Body temperature and any flu-like symptoms should be recorded at least twice daily for both patient and the accompanying parent.

### Management post-COVID peak

This issue has been dealt by three associations and two papers [3, 4, 6, 7, 9]. This has been most elaborately discussed by BAPU and have categorized into A1, A2, B, C, D, and E categories. A1 gets the utmost priority, while category D and E can wait up to 6 and 12 months, respectively. The BAPU has stressed that pediatric urology care is not just about the immediate treatment of a condition that is why guidelines have taken into account normal physical and psychological needs also into account [3].

EAU mentions that it is not possible to predict that peak is over, but planning should be done beforehand. Prioritisation will be required even once the pandemic is over due to the long waiting list and obstructive uropathies should get preference over other benign diseases [9]. Cini et al. [7] have also emphasised the need to stratify the patients as per the extent of risk. Fernandez et al. opined that the long waiting list and limitations of the hospital beds should be tackled by performing pyeloplasty, ureteral reimplantation,

etc. as a day care procedure. To avoid re-admission for the removal of D-J stents, a string may be left to remove them post-operatively at home or in the out-patient clinic without the need of anaesthesia. The long waiting list may be dealt by increasing the OR time and working on the weekends [6]. CUA suggests that the use of telemedicine in clinics should be continued even once the current pandemic resolves. The ideal candidates for telemedicine are those who have the means and motivation to be assessed in this fashion, availability of local physician to participate as a partner, and feasibility of getting imaging investigations outside of the hospital environment [4].

### Author's view point

Already, the disease has exceeded the initial expectations about its longevity, durability, and impact. We believe that categorization of procedure as deferrable by time frames like 6 weeks, and 2 or 3 months might be too short. A longer time frame may be required, viz., a procedure that can be deferred until the end of the COVID-19 emergency. This is especially true for larger nations where the COVID era might be exceedingly prolonged and post-COVID peak might get delayed. However, we are aware that majority of the end-organ damage in Pediatric Urology is insidious and slow. Unnecessary delays in required surgical procedures may lead to loss of function which might never be reversed. The time frames for surgical procedure deferment must necessarily balance these two competing concerns, viz., hospital and healthcare professional safety versus insidious and slow end-organ damage. The prolonged delay in the treatment of UDT may lead to worrisome consequences, including infertility, hypogonadism, and increased risk of malignancy. The every 6 months of delay in the treatment of cryptorchidism can increase the risk of needing assisted reproductive technologies by 5% [11]. The delay may also lead to increased psychological burden due to delayed diagnosis and surgery. The treating clinician should try to assess the mental trauma inflicted on patient either due to the social distancing norms or delayed surgery and may consider seeking the opinion of psychiatrist or psychologist whenever indicated. It mandates us to triage these not so urgent cases also as soon as the acute COVID-19 crisis is over to minimise these long-term irreversible consequences.

The society recommendation is to keep one bed in each room to avoid cross-infection, but it may not be feasible at all times specially in developing world and even in developed nations when the exponential increase in numbers have overwhelmed the available resources. Alternatively, in general wards, we can physically increase distances between beds and to incorporate methods to improve the ventilation/air changes of the large spaces by installing exhaust fans, etc.. Some measures of limited patient examination protocols

may also be put in place to avoid unnecessary exposure of patients to healthcare professionals and vice versa. These physical visits in hospitals can be replaced by remote monitoring protocols including video consultations.

We see that the rate of COVID peaks and intensity is variable across nations and across continents. Larger countries like US, India, Russia might not be as homogenous with regards to the state of the COVID pandemic as compared to a smaller nation. From our experience in India, we find that even states and cities may differ from each other as far as the stage of the pandemic is concerned. Thus, we believe that one size fits all recommendations might not be appropriate in all settings. In fact, any recommendations from national committees and professional bodies should be seen as guidelines which should be tailor made and modified for the Institution taking into account the ground realities. The departments and administration must take a call regarding the state of elective cases based on the local level of the stage of the pandemic rather than blindly relying on national or international consensus.

As data on the safety of laparoscopy during the COVID-19 era become more widespread and available, the recommendations and safety precautions with regards to laparoscopy might also need to be re-evaluated and revisited.

Most children with COVID-19 have mild-to-moderate symptoms. Severe disease is more common in patients < 1 year old [9]. The pediatric patients with mild symptoms have good prognosis, but could be silent carrier of the disease. This mandates that every patient in the ward be considered as potential carrier of the disease and appropriate measures are taken like social distancing, hand hygiene, and proper use of PPE.

There has been lots of debate about the optimal use of PPE during the initial phase of pandemic when there was scarcity of PPE and the rapid antigen tests were not easily available. Now, most countries have been able to match the demand of the PPE by increasing the manufacturing capacity or by import. In addition, the availability of rapid antigen test has enabled expeditious determination of COVID status. The surgical masks are designed to protect against particles or droplets with size more than 100 microns. The coronavirus-2 has a diameter of 60–140 nm and surgical masks are ineffective to protect against this virus. We believe that during this COVID pandemic surgeons should preferably wear the N-95/filtering face piece-3 (FFP-3) masks irrespective of the COVID status/type of surgical procedures. In case, there is limited availability of the FFP-3 masks then its use may be prioritised depending on the COVID status of the patients. Similarly, in view of paucity of literature in the area of aerosolization of COVID-19, it is better to be err on the side of safety using CO2 filters, smoke evacuation device, and complete desufflation before specimen retraction and port removal during all procedures. The authors also believe

that in patients with COVID positive status, it is better to do the most minimal intervention possible for example double J stent insertion or per cutaneous nephrostomy instead of pyeloplasty.

For emergency procedures where patients cannot wait for COVID-19 test results or when COVID test is positive, then these patients are to be admitted in dedicated COVID wards or dedicated COVID suspect wards with strict infection prevention protocols. The surgery should be performed in dedicated theatres with full personal protective equipment. This guideline will necessarily evolve with card-based Antigen testing and antibody testing for COVID-19 which are much quicker to retrieve (matter of minutes rather than hours/days). These faster methods to diagnose COVID-19-like Antigen-based card testing can thus become a point of care based tests and can rapidly segregate positives from the negatives. Wider availability of these available and a more streamlined and defined segregation and operative protocol can be defined.

On the positive front, this pandemic may unravel new information about the natural history of some congenital anomalies, and may also question the current indications and timing of surgery for these conditions. The basis and necessity of certain routine practices may also be invalidated later. For example, need of routine follow-up after common surgeries like, hernia, hydrocele, hypospadias, undescended testis, pyeloplasties, and ureteric reimplantation. Post-operative follow-up of these patients, even post-pandemic, may be done by telemedicine in collaboration with the local clinician, reducing the parent or caregiver burden. The video calling during telemedicine permits virtual inspection of the patient and local pathology. The virtual inspection can actually provide a lot of information about general condition of the patient, more so, in case of neonates and young infants. Comfortably lying playful infant is always reassuring to the treating clinician. Contrary to it, sick looking, irritable, or lethargic baby is a red flag sign indicating sepsis and mandates urgent in-person clinical assessment. Thus, telemedicine may replace routine follow-up for many conditions even after the pandemic is over.

Another positive role this pandemic may play is creating awareness about disinfection protocols, hand-hygiene among the medical personnel and general public. If properly enforced and “marketed” to the health care professionals, there is a possibility of a more implicit and voluntary acceptance of such infection control measures. This may strengthen the infection control measures in a hospital including a voluntary acceptance. The benefits of these measures may outlast the pandemic and is welcomed.

## Limitations of the study

This systematic review could retrieve very few articles due to scarcity of literature focussing the pediatric urology protocols in relation to the corona pandemic. Most of the guidelines are consensus-based and expert opinions only. These guidelines are mostly from the developed world and do not consider overcrowded conditions, illiterate population, severe lack of resources, poor hygiene, lack of trained pediatric urologist, etc. in the developing world into account. We see that the rate of COVID peaks and intensity is variable across nations and across continents. Even states and cities may differ from each other as far as the stage of the pandemic is concerned. These recommendations may not be applicable to all.

## Future directions

There is a need to evaluate the positive impact of these guidelines. Evaluation is also needed of the collateral damage due to delayed diagnosis and treatment. Separate local guidelines and guidelines suitable for the developing nations are needed. There must be many issues implementing the international guidelines in the local setting and these guidelines must have been modified accordingly. Literature related to the nuances of the implementation of the guidelines also need to be published. Already the disease has exceeded the initial expectations about its longevity, durability, and impact; the categorization of procedure as deferrable by time frames like 6 weeks, and 2 or 3 months might be irrelevant now. A longer time frame is required, viz., a procedure that can be deferred until the end of the COVID-19 emergency.

**Acknowledgements** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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