



Strategies to Deliver Urology Services in the Times of COVID-19 Pandemic Based on Current Literature

Shiv Charan Navriya*, Satish Kumar Ranjan, Sunil Kumar, Ashwani Kumar Kandari, Tushar Aditya Narain and Kim Jacob Mammen

Department of Urology, All India Institute of Medical Sciences (AIIMS), Rishikesh, India

Abstract

COVID-19 disease was first reported in Wuhan city of China, since then this is spreading with alarming speed and had already affected more than 213 countries around the world. The COVID-19 pandemic has had a global impact on all sectors of public health and hospital services. Naturally, urology services have been affected too with several patients, suffering from urological malignancies and renal stone disease, left to their fate. Present records hint towards this pandemic continuing at least till the end of this year and it is only prudent that we come up with strategies to re-initiate urological services in a phased and a safe manner to tackle both, the urological diseases and the COVID-19 infection. This review aims at providing recommendations for resumption of urological services in a phased manner, based on the available evidences in literature.

Keywords: COVID-19; Pandemic; Urological services; Resumption; Strategies

Introduction

The Coronavirus Disease 2019 (COVID-19), caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was first reported in Wuhan City, Hubei Province in China on the 31st December 2019. With the concern of the alarming spread of infection and severity of disease, World Health Organization (WHO) declared COVID-19 as a Public Health Emergency of International Concern (PHEIC) on 30th January and as a pandemic on 11th March 2020 [1]. This pandemic has already affected more than 213 countries around the world, with an approximate burden of 8.40 million cases and 0.45 million deaths. The United States of America (USA), Russia, Spain, United Kingdom (UK), Italy, France and Germany have been the worst affected countries despite having a world-class health care system, with the USA heading the list with 1.5 million cases and more than 93,000 deaths [2]. Although affected countries have been in a state of complete lockdown for many weeks, no measures stopped the spread of this virus, and transmissions reached at a stage of community-level and have resulted in havoc on healthcare system [3].

The COVID-19 pandemic has had a global impact on all sectors of public health and hospital services. Naturally, urology services have been affected too with several patients, suffering from urological malignancies and renal stone disease, left to their fate. Present records hint towards this pandemic continuing at least till the end of this year and it is only prudent that we come up with policies to re-initiate urological services in a phased and a safe manner to tackle both, the urological diseases and the COVID-19 infection.

A risk-benefit assessment for each patient requiring a urological intervention should be done during this COVID-19 pandemic based on the nature of the disease (benign vs. malignant), risk of disease progression, impact on life if left untreated, postponed or managed medically and the risk of viral illness and transmission. Taking clues from the previous pandemic, COVID-19 too may continue for years, and we cannot afford to leave our patients untreated all this while. This review aims at providing recommendations for resumption of urological services in a phased manner, based on the available evidences in literature [4].

General Measures

Every patient visiting the hospital should undergo a general symptomatic screening for COVID-19, including history of travel, before referring to a specialty clinic. At this stage, health care workers must have a N95/triple layer surgical mask and must use disposable gloves for the examination of the patients considering the potential source of infection from an asymptomatic case. Hospitals can be divided into COVID and Non-COVIDs block and all patients who require

OPEN ACCESS

*Correspondence:

Shiv Charan Navriya, Department of Urology, All India Institute of Medical Sciences (AIIMS), Rishikesh, India, E-mail: drshivnavriya2004@gmail.com

Received Date: 06 Jul 2020

Accepted Date: 03 Aug 2020

Published Date: 10 Aug 2020

Citation:

Navriya SC, Ranjan SK, Kumar S, Kandari AK, Narain TA, Mammen KJ. Strategies to Deliver Urology Services in the Times of COVID-19 Pandemic Based on Current Literature. *Clin Surg.* 2020; 5: 2907.

Copyright © 2020 Shiv Charan Navriya. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

admission to the hospital can be admitted in COVID block in different rooms/areas and shifted to the Non-COVID area, once COVID-19 test report comes negative.

Manpower should be divided into three pools and at a time, only one team should be working keeping others in reserve to minimize exposure. Specific testing of COVID-19 by Reverse Transcription Polymerase Chain Reaction (RT-PCR) should be done in all patients who are symptomatic, have a contact history, require admission in the hospital or are planned for a surgical intervention and may be done in all old age patients with multiple comorbidities, because of high mortality in this group of patients [5]. The various Royal Colleges of United Kingdom jointly issued a statement, the “Intercollegiate General Surgery Guidance on COVID-19”. Adequate Personal Protective Equipment (PPE) and N95 Mask for the surgical team is essential to protect healthcare workers and ensure an adequate workforce available to treat patients. A negative pressure room is strongly recommended for intubation/extubation with an experienced anesthesiologist to minimize exposure in a COVID-19 suspected or proven case. All standard precautions should be maintained in the Operating Room (OR), including minimal personnel to be present inside the OR, mandatory PPE to be worn by all, even if the patient is negative for the COVID-19 test. If possible, a dedicated OR should be available with a trained team of healthcare workers including experienced surgeons, anesthesiologists, OR technicians, nursing officers, and ground staff. A complete record of manpower used in different areas should be maintained [4].

Adaptations to Dance with COVID-19 Pandemic

The usual urological diseases did not cease to cause morbidity and mortality while the SARS-CoV-2 virus was creating havoc worldwide. Urological malignancies and chronic kidney diseases continued to kill all this while. We need to strike a balance between providing urological services and conserving resources to face the biggest menace of all times. In order to combat increasing number of COVID-19 cases, reallocation of resources with redistribution of health care workers is the need of the hour as there will be an ever-increasing demand for beds and ventilators [6]. The decision to go ahead with a particular surgery should be based on meticulous risk-benefit analysis, considering the available healthcare resources and the deleterious effects of delaying a particular surgery [7] (Figure 1).

Strict adherence to COVID-19 safety guidelines, social distancing, entrance screening, waiting room policy, a visitor’s policy and separate staff to treat non-COVID19 patients are required. Considering the reported increased incidence of post-operative morbidity and mortality, it is advised to get pre-operative COVID-19 screening test in all patients and a mandate for patients with clinical symptoms or close contacts of COVID-19 patient or belonging to a hotspot area. Further decision of scheduling a case for surgery should be based on a prioritization strategy prepared for that institute. Time to time review of COVID-19 metrics and statics in local area are required frequently to reassess and reconsider a change in policy. Any plan in this crisis should be dynamic and should change as the situation unfolds [8].

Encouraging Telemedicine Services

Although the initial thoughts behind promoting telemedicine services were to provide health services to remote rural and sequestered areas [10], but this pandemic has unearthed the undiscovered potentials of distant telemedicine services and virtual

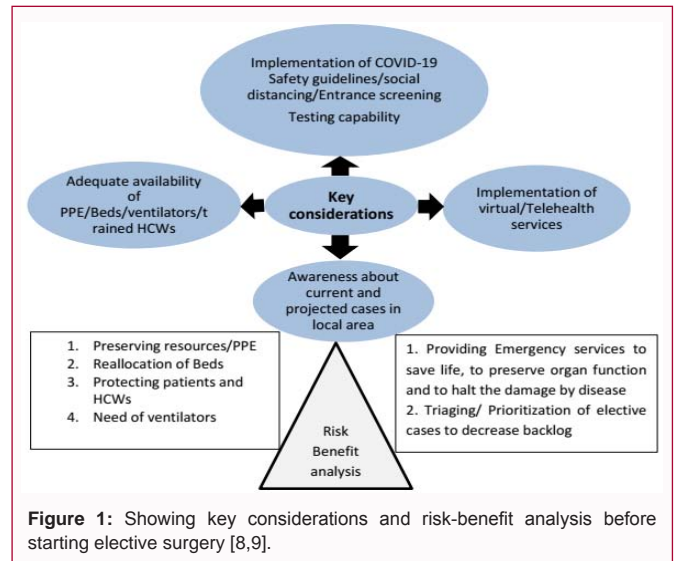


Figure 1: Showing key considerations and risk-benefit analysis before starting elective surgery [8,9].

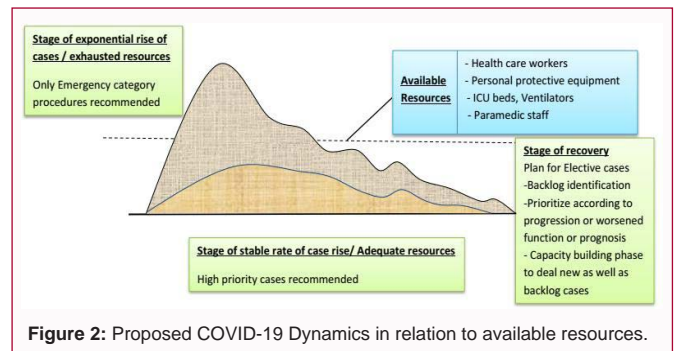


Figure 2: Proposed COVID-19 Dynamics in relation to available resources.

OPDs. Telemedicine can be accessible anywhere and avoids a hospital visit, thus keeping both patient and health care providers safe. The ways of communication in telemedicine can be text message, voice calls or audio-video using social media platforms, telephonic calls or special telehealth applications [11]. The discipline of urology has immense potential of using telemedicine services by providing prescription to non-operative patients, to triage a patient for hospital visit, for preoperative assessment and to follow-up in post-operative period allowing them to stay away from the hospital environment [12].

Triage and Prioritization of Urology Services According to Slope of Curve

The rationale for prioritization is to provide surgical care timely to needy patient while preserving resources including PPE, beds, and ventilators and sparing health care workers to provide alternate services related to COVID-19 pandemic [6]. Determining which urology procedures can be safely delayed, should be based on the severity of disease, risk from delaying surgery, probable length of hospital stay, local healthcare resources and COVID-19 statics in that particular geographical region [13]. Approaches to urological conditions should be tailored to individual settings, and preferably should have a shared decision making of both patient and treating urologist. Ample evidences are available in literature to guide us regarding the effects of delay of the particular procedure. Compiling these available evidences, we have tried to simplify the recommendations, pertinent to a given area with its burden of the COVID-19 disease (Table 1).

Table 1: Prioritization of Urological procedures.

Category	Emergency	High priority	Elective	Non-essential	Comments
Priority definition [15,16]	Emergency, lifesaving cases and procedures which will lead to adverse consequences if not done within one week	potential for future morbidity and mortality if delayed for >6 weeks	Clinical harm possible if postponed for 3 to 6 month	Harmful consequences unlikely if postponed for >6 month	
Urolithiasis					
Disease	Emergency	High priority	Elective	Non-essential	Comments
Renal calculus [17]	Drainage with PCN or stent if renal failure, urosepsis, obstruction in bilateral or solitary kidney	DJ stenting in 'Recurrent or intermittent obstruction or flank pain'	partial or complete staghorn stones [17]	Other asymptomatic renal stones	DJ Stenting or Nephrostomy tubes can be placed under local anesthesia, sparing a ventilator Removal can be simple for most stents left in place even for up to 6 to 12 month ^{18,19}
Ureteric calculus	Drainage in Ureteric stone with AKI or infection	Trial of MET in mildly symptomatic stones of <7 mm Drainage vs. treatment in stones not responding to MET and with intractable symptoms	Ureteral/renal stone with pre-existing stent		
Bladder/Urethral calculus [17]	Urinary drainage		Bladder stone with indwelling catheter		
Neuro-urology/Female urology/LUTS [15,16]					
	Emergency	High priority	Elective	Non-essential	Comment
Evaluation		PVR, Urine culture, Bladder diary		Urodynamic study	
Management					
<i>Subspecialty disease</i> Urinary incontinence, interstitial cystitis, overactive bladder, neurogenic bladder	Indwelling catheter and management as per protocol if associated with retention, infection, renal failure Removal of Infected implants if associated with systemic symptoms	Tele consultation Advice CIC for suspected neurogenic bladder	Defer follow-up visit	Delay all including Anti-incontinence surgery (MUS, TVT/TVT-O), augmentation, Mitrofanoff	
BPH [20]		Tele consultation Continue conservative and pharmacological management	Delay BPH procedures (TURP, HoLEP, PVP)	Urinary obstruction can be adequately treated via a urethral or suprapubic catheter	
Reconstructive Urology					
Disease	Emergency	High priority	Elective	Non-essential	Comments
Urethral [16] stricture	SPC or perurethral catheter for retention, renal failure, sepsis			Urethral reconstruction	Reconstructive surgeries are resource-intensive and should be delayed [16]
Genito-urinary fistula	Urinary Diversion if associated with sepsis	Fecal diversion if bowel involvement	Management of oncologic fistulas	Delayed definitive repair unless clinical conditions would require immediate repair	
Pyeloplasty [16]	Drainage if associated with renal failure, sepsis		Repair if concern of renal loss		
Renal transplantation [20]					
	Emergency	High priority	Elective	Non-essential	Comments
Procedure Priority	Deceased donor renal transplant Combined transplants Urgent dialysis-access Testing of organ donor for SARS-CoV-2		Living related transplant		For transplantation a high level multi interdisciplinary integrated system is needed, To spare resources and delay the immunosuppression for recipients, which could have an impact on COVID-19 infection [21]
Follow-up	Life threatening situations like vascular complications, sepsis Diversion nephrostomy for obstruction	Standard Evaluation for graft rejection	Tele video consultation Hospital visits should be avoided Continue to use standard immunosuppression according to established protocols		
Uro-oncology [16,20,22]					

Organ	Emergency	High priority	Elective	Non-essential	Comments
Kidney	RN for Renal mass with ongoing hematuria Angioembolization can be considered if available	>cT2b renal mass Symptomatic renal mass Renal mass with IVC or renal vein thrombus TKI in Metastatic RCC irrespective of IMDC risk category	Partial or radical nephrectomy for other asymptomatic renal masses [23] Consider CN in IMDC Good & Intermediate risk		Large, advanced renal tumors with vein thrombi, may progress rapidly and adversely affect survival [24]
UTUC [22,25]	Radical nephroureterectomy as a palliative treatment to symptomatic patients haematuria, Excruciating pain	Radical nephroureterectomy (RNU) with bladder cuff excision in high risk (Size >2 cm, variant histology, presence of hydronephrosis, multifocality), nonmetastatic UTUC	Low risk UTUC unifocal disease, Size <2 cm, non invasive on CT urography		3-month delay to surgery for UTUC has been associated With disease Progression [24]
Bladder [16]	TURBT in bladder tumor with hematuria Consider Hemostatic Radiotherapy for Intractable hematuria PCN for renal failure secondary to bladder tumor	Restage TURBT [26] in patients with visibly residual tumour or in patients with large/T1 tumors without muscle in initial resection TURBT in suspicious invasive tumor on imaging Consider to avoid NACT Radical cystectomy with urinary diversion in cT2-4N0M0 Consider multimodality bladder sparing therapy for selected T2N0M0 patients In metastatic disease offer cisplatin based chemo or Pembrolizumab	Cystectomy (MIBC, BCG-refractory), Chemoradiation should be offered to improve local control in cases of inoperable locally advanced tumors Adjuvant chemo in pT3-T4, pN1-N2-N3		Delaying cystectomy for MIBC by 90 d increases pN + rate, decreases OS and progression-free survival [27,28]
Prostate [16]		Consider upfront mpMRI and if high risk and symptomatic proceed for biopsy [29] For locally advanced prostate cancer (including cN1) Consider long term ADT + EBRT For metastatic hormone sensitive prostate cancer offer systemic treatment with ADT For metastatic castration-resistant prostate cancer abiraterone acetate plus 5 mg daily prednisone or enzalutamide)	Defer treatment for low risk localized cancer Consider Radiotherapy in intermediate risk in hypofractionation (20x3 Gy) starting with neoadjuvant ADT Consider Prostatectomy or neoadjuvant ADT up to 6 months followed by EBRT and long term ADT for high risk localized ca prostate [31]	Defer screening and early detection	Biochemical recurrence rates may be higher in high risk men who delay definitive treatment ³⁰ Avoid chemotherapy(Docetaxel) due to risk of neutropenia requiring frequent hospital visits [32]
Testis [16,22,23]	offer 3 cycles of BEP in CS IIA , II B and IGCCCG good risk metastasis of both seminoma and NSGCT In Metastatic disease (Stage II C and III) IGCCCG Intermediate and High Risk group NSGCT and intermediate risk seminoma offer 4 cycles of BEP	If not willing for AS in high risk CS I consider one cycle of carboplatin in seminoma and one cycle of BEP in NSGCT Radiotherapy can be considered in stage IIA seminoma	Consider Active Surveillance (AS) in CS I of seminoma and NSGCT Consider RPLND for postchemotherapy residual masses with normal markers and in growing teratoma cases		orchietomy is an outpatient procedure with potential OS benefit [33]
Penis [16,20,34]	Relieve urinary obstruction, excruciating pain and blood transfusion if required Best supportive care for distant metastasis	In cN1-2 offer radical inguinal lymphadenectomy and Ipsilateral pelvic dissection if pN2/pN3 in ipsilateral groin Offer neo-adjuvant chemotherapy in T4/cN3 and consider surgery in responder patients	Topical treatment, Circumcision, wide local excision, Ablative therapies, Glans resurfacing Delayed adjuvant chemotherapy in pN2/3 inguinal nodes		
Andrology and infertility [16,20,22]					

Disease	Emergency	High priority	Elective	Non-essential	Comments
Erectile dysfunction [35]		Teleconsultation comprehensive medical and psychosexual history in every patient	Use PDE5 inhibitors as first-line therapy		
Infertility	Sperm cryopreservation after discussion in patients with testicular tumor as per standard practice before orchidectomy		Evaluation of both partners simultaneously Delay elective surgical sperm retrieval and fertility procedures		
Hypogonadism		conventional medical therapies for treating severe depressive symptoms, lifestyle change and weight reduction Analgesics for penile pain	Hormonal therapy		
Peyronie's disease [35]		Phosphodiesterase type 5 inhibitors for associated ED	Should not offer experimental therapies	Surgical treatment	
General urology					
Disease	Emergency	High priority	Elective	Non-essential	Comments
Vascular [16,22]	Aspiration or shunting for priapism Orchidopexy for torsion testis Angioembolization or surgical exploration for AML bleeding				
<i>Minor Urology Office procedures</i> Cystoscopy [35]		Diagnostic cystoscopy for microscopic hematuria with risk factors (smoking, occupation etc.) Check cystoscopy for high risk NMIBC within 6 month of initial diagnosis	Diagnostic cystoscopy for microscopic hematuria without risk factors Check cystoscopy for intermediate or low risk NMIBC		Chances of Diagnostic yield of bladder cancer or upper tract malignancy is high in symptomatic patients with risk factors and low chances in asymptomatic microscopic hematuria Risk of recurrence/ progression highest within 6 month Most significant benefits of BCG therapy is provided during induction course
BCG Instillation [22,32]	Diagnostic cystoscopy for gross hematuria	Induction intravesical bacillus-Calmette Guerin (BCG) in High risk NMIBC Stop maintenance BCG and re-evaluate at 3 months Androgen Deprivation Therapy for ca prostate Consider MpMRI	Check cystoscopy for high risk NMIBC beyond 6 month of initial diagnosis		
ADT [16,22,32]			Biopsy can be delayed upto 3 month in suspicious high risk ca prostate (PSA) greater than 20, rapid PSA doubling time less than 6 months, digital rectal examination concerning for clinical T3 disease, and/or symptoms	Biopsy can be delayed up to 6 month in suspicious low risk prostate cancer	Effects of Delay in diagnosis by 3 months in high risk and by 6 month in intermediate risk prostate cancer unlikely to change long-term oncologic outcome
Prostate [32,35] biopsy		If associated with stent related symptoms [17]	Asymptomatic stent patients		
Ureteral stent removal after ureteroscopy					
Chronic Pelvic Pain			Offer multimodal behavioral, physical and psychological treatment along with standard therapies	Diagnostic evaluation	

Urological trauma					
Organ	Emergency	High priority	Elective	Non-essential	Comment
Kidney [15,16]	High grade renal trauma with active bleeding – Angioembolization if stable vitals, surgical exploration if unstable	Try early discharge of stable patients up to grade IV injury			
Ureter [15]		Nephrostomy/DJ stent placement	Further reconstruction at later date if requires		
Bladder [15,35]	Immediate surgical exploration of intraperitoneal perforation	Conservative management of extraperitoneal and small iatrogenic intraperitoneal perforation			
Urethra [15]	Gentle urethral catheter or SPC placement	Repair of female urethral injury	Urethroplasty at later date		
Genital injury [15]	Penile fracture repair	Testicular trauma with tunica rupture			
Paediatric Urology					
	Emergency	High priority	Elective	Non-essential	Comments
Timeline of surgeries [15,16]	Diversion in sepsis or renal failure due to obstruction Torsion of testis Urolithiasis with obstruction or sepsis Macroscopic hematuria Complicated inguinal hernia Abscess, PUV with urine retention	Pyeloplasty with possible loss of function or severely symptomatic specially in solitary kidney/Bilateral PUJO	Anti-reflux surgery for VUR Routine pyeloplasty	Hydrocele, hypospadias Orchidopexy, circumcision, bladder exstrophy repair, inguinal hernia	

The first scenario is a state of exponential rise of COVID-19 cases and exhausted health care resources; in such a situation, only emergency lifesaving procedures should be performed. Second scenario includes availability of adequate health resources and stable rate of rise in COVID-19 cases; high priority cases can be catered to besides the emergency surgeries. Third scenario is a stage of decline of cases and re-established supply chain of resources; this is a phase of capacity building and backlog of cases should be identified and elective cases should be resumed [14,15] (Figure 2).

Perioperative Adaptations

All the health care workers must have graded step wise training of donning and doffing [36]. The personal protection kit must be government authorized and shall be pre-available in OR (operating rooms). Powered air purifying respirators if possible, should be made available with PPE kits. A detailed surveillance must be done of all the OR staff followed by a simulation course incorporating all the precautionary steps relating to COVID-19 [37].

Staff should be divided into teams and the team members should not come in contact with members of the other. All surgeries should be performed by experienced surgeon with established standard techniques. Senior surgeons above 60 years may play the role of coordinators and make way for their younger colleagues as senior citizens have been most susceptible for the disease [37].

OTs must be divided into COVID and non COVID OTs. All precautions must be taken to keep COVID OT away from regular elective OTs as far as possible. There are plenty of reports in literature suggesting risk of infection by evaporated smoke during surgery so attempts should be made to minimize the smoke and aerosol generation. Electrocautery devices should be used minimum and minimal invasive surgery with laparoscopy and robotics should have minimum intra-abdominal pressure with closed evacuation system for gas [38,39].

The US center for disease control and prevention recommends a negative pressure airborne infection isolation room for patients undergoing aerosol generating procedures. All the OTs must remain closed for 10 min before intubation and after extubation. There shall

be minimum and restricted movement from the OR. Prior to a surgery all necessary items must be brought to OR. The main anesthesia trolley should remain outside the OR with minimum drugs to be prepared and taken into OR. The drugs taken inside the OR room must be pre-prepared into disposable syringes and labeled. In case of difficult airway video-laryngoscope may be used with disposable blades owing to the fact that it becomes difficult to intubate a patient with impaired vision due to PPE/goggles [37].

Conclusion

Current statics predicts a long war with COVID-19, and it would be wise to resume routine urological services in a prioritized graded manner to avoid accumulation of large number of cases requiring intervention. Timely and appropriate urological care should be made available while at the same time, resources and manpower should be conserved so as to be in a position to fight both, the urological diseases and the SARS-CoV-2 virus, and emerge triumphant.

References

1. WHO 2020 WHO Timeline- COVID-19. WHO Timeline - Covid-19. 2020.
2. Worldometer 2020 COVID-19 coronavirus pandemic. [Last accessed on 2020 June 18].
3. Government of India COVID-19 tracker. [Last accessed on 2020 May 20].
4. RCSE 2020 Intercollegiate General Surgery guidance on COVID -19 Update. [Last accessed on 2020 May 20].
5. Gupta N, Agrawal H. COVID 19 and laparoscopic surgeons, the Indian scenario - Perspective. *Int J Surg*. 2020;79:165-7.
6. Creating Surge Acute ICU capacity.
7. Lodha R, Kabra SK. COVID-19: How to prepare for the pandemic? *Indian J Pediatr*. 2020;87(6):405-8.
8. Local Resumption of Elective Surgery Guidance. American College of Surgeons.
9. Joint Statement: Roadmap for Resuming Elective Surgery after COVID-19 Pandemic. American College of Surgeons.
10. Ellimoottil C, Skolarus T, Gettman M, Boxer R, Kutikov A, Lee BR, et al.

- Telemedicine in urology: State of the art. *Urology*. 2016;94:10-6.
11. Boehm K, Ziewers S, Brandt MP, Sparwasser P, Haack M, Willems F, et al. Telemedicine online visits in urology during the COVID-19 pandemic-potential, risk factors, and patients' perspective. *Eur Urol*. 2020;78(1):16-20.
 12. Gadzinski AJ, Ellimoottil C. Telehealth in urology after the COVID-19 pandemic. *Nat Rev Urol*. 2020;17(7):363-4.
 13. Clinical Issues and Guidance. American College of Surgeons.
 14. Soreide K, Hallet J, Matthews JB, Schnitzbauer AA, Line PD, Lai PB, et al. Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. *Br J Surg*. 2020.
 15. Ribal MJ, Cornford P, Briganti A, Knoll T, Gravas S, Babjuk M, et al. European Association of Urology Guidelines Office Rapid Reaction Group: An Organization-Wide Collaborative Effort to Adapt the European Association of Urology Guidelines Recommendations to the Coronavirus Disease 2019 Era. *Eur Urol*. 2020;78(1):21-8.
 16. Heldwein FL, Loeb S, Wroclawski ML, Carneiro A, Lima FS, Teoh JYC, et al. A systematic review on guidelines and recommendations for urology standard of care during COVID-19 pandemic. *Eur Urol Focus*. 2020.
 17. Metzler IS, Sorensen MD, Sweet RM, Harper JD. Stone care triage during COVID-19 at the University of Washington. *J Endourol*. 2020;34(5):539-40.
 18. Nourparvar P, Leung A, Shrewsbury AB, Weiss AD, Patil D, Atallah H, et al. Safety and efficacy of ureteral stent placement at the bedside using local anesthesia. *J Urol*. 2016;195(6):1886-90.
 19. Polat H, Yücel MÖ, Utangaç MM, Benlioğlu C, Gök A, Çift A, et al. Management of forgotten ureteral stents: Relationship between indwelling time and required treatment approaches. *Balkan Med J*. 2017;34(4):301-7.
 20. Stensland KD, Morgan TM, Moinzadeh A, Lee CT, Briganti A, Catto JWF, et al. Considerations in the triage of urologic surgeries during the COVID-19 pandemic. *Eur Urol*. 2020;77(6):663-6.
 21. Guidance on Coronavirus Disease 2019 (COVID-19) for Transplant Clinicians. The Transplantation Society. 2020.
 22. Desouky E. Urology in the Era of COVID-19: Mass Casualty Triage. *Urol Pract*. 2020.
 23. Mano R, Vertosick EA, Hakimi AA, Sternberg IA, Sjoberg DD, Bernstein M, et al. The effect of delaying nephrectomy on oncologic outcomes in patients with renal tumors greater than 4 cm. *Urol Oncol*. 2016;34(5):e1-239.e8.
 24. Froehner M, Heberling U, Zastrow S, Toma M, Wirth MP. Growth of a level III vena cava tumor thrombus within 1 month. *Urology*. 2016;90:e1-2.
 25. Bourgade V, Drouin SJ, Yates DR, Parra J, Bitker MO, Cussenot O, et al. Impact of the length of time between diagnosis and surgical removal of urologic neoplasms on survival. *World J Urol*. 2014;32(2):475-9.
 26. Zehnder P, Thalmann GN. Timing and outcomes for radical cystectomy in nonmuscle invasive bladder cancer. *Curr Opin Urol*. 2013;23(5):423-8.
 27. Liang W, Guan W, Chen R, Wang W, Li J, Xu K, et al. Cancer patients in SARS-CoV-2 infection: A nationwide analysis in China. *Lancet Oncol*. 2020;21(3):335-7.
 28. Fahmy NM, Mahmud S, Aprikian AG. Delay in the surgical treatment of bladder cancer and survival: Systematic review of the literature. *Eur Urol*. 2006;50(6):1176-82.
 29. Ahmed HU, Bosaily AE, Brown LC, Gabe R, Kaplan R, Parmar MK, et al. Diagnostic accuracy of multi-parametric MRI and TRUS biopsy in prostate cancer (PROMIS): A paired validating confirmatory study. *Lancet*. 2017;389(10071):815-22.
 30. Fossati N, Rossi MS, Cucchiara V, Gandaglia G, Dell'Oglio P, Moschini M, et al. Evaluating the effect of time from prostate cancer diagnosis to radical prostatectomy on cancer control: Can surgery be postponed safely? *Urol Oncol*. 2017;35(4):150.e9-150.e.15.
 31. Loeb S, Folkvaljon Y, Robinson D, Makarov DV, Bratt O, Garmo H, et al. Immediate versus delayed prostatectomy: Nationwide population-based study. *Scand J Urol*. 2016;50(4):246-54.
 32. COVID-19 Facts and Resources cancer COVID-19 guidelines. Genitourinary Cancer Treatment Center
 33. Dana-Farber/Brigham and Women's Cancer Center. 2020.
 34. Huyghe E, Muller A, Mieusset R, Bujan L, Bachaud JM, Chevreau C, et al. Impact of diagnostic delay in testis cancer: Results of a large population-based study. *Eur Urol*. 2007;52(6):1710-6.
 35. Gao W, Song LB, Yang J, Song NH, Wu XF, Song NJ, et al. Risk factors and negative consequences of patient's delay for penile carcinoma. *World J Surg Oncol*. 2016;14:124.
 36. Howard B. Goldman, George P. Recommendations for tiered stratification of urological surgery urgency in the COVID-19 Era. *J Urol* 2020;204(1):11-13.
 37. Vijayakumar V. Personal protection prior to preoperative assessment—little more an anesthesiologist can do to prevent SARS-CoV-2 transmission and COVID-19 infection. *Ain-shams J Anesthesiol*. 2020;12(1):13-15.
 38. Coccolini F, Perrone G, Chiarugi M. Surgery in COVID-19 patients: operational directives. *World J Emerg Surg*. 2020;15(1):25.
 39. Kwak HD, Kim SH, Seo YS, Song KJ. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. *Occup Environ Med*. 2016;73(12):857-63.
 40. Li CI, Pai JY, Chen CH. Characterization of smoke generated during the use of surgical knife in laparotomy surgeries. *J Air Waste Manag Assoc*. 2020;70(3):324-32.