

Effect of SARS and COVID-19 outbreaks on urology practice and training

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ABSTRACT

Introduction: The objective was to investigate the changes in urology practice during coronavirus disease 2019 (COVID-19) pandemic with a perspective from our experience with severe acute respiratory syndrome (SARS) in 2003.

Methods: Institutional data from all urology centres in the Hong Kong public sector during the COVID-19 pandemic (1 Feb 2020–31 Mar 2020) and a non-COVID-19 control period (1 Feb 2019–31 Mar 2019) were acquired. An online anonymous questionnaire was used to gauge the impact of COVID-19 on resident training. The clinical output of tertiary centres was compared with data from the SARS period.

Results: The numbers of operating sessions, clinic attendance, cystoscopy sessions, prostate biopsy, and shockwave lithotripsy sessions were reduced by 40.5%, 28.5%, 49.6%, 44.8%, and 38.5%, respectively, across all the centres reviewed. The mean numbers of operating sessions before and during the COVID-19 pandemic were 85.1 ± 30.3 and 50.6 ± 25.7 , respectively ($P=0.005$). All centres gave priority to cancer-related surgeries. Benign prostatic hyperplasia-related surgery (39.1%) and ureteric stone surgery (25.5%) were the most commonly delayed surgeries. The degree of reduction in urology services was less than that during SARS (47.2%, 55.3%, and 70.5% for operating sessions, cystoscopy, and biopsy, respectively). The mean numbers of operations performed by residents before and during the COVID-19 pandemic were 75.4 ± 48.0 and 34.9 ± 17.2 , respectively ($P=0.002$).

Conclusion: A comprehensive review of urology practice during the COVID-19 pandemic revealed

changes in every aspect of practice.

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New knowledge added by this study

- As in other parts of the world, the impact of coronavirus disease 2019 on urology affected all key aspects of service. However, the degree of impact was less than that during the severe acute respiratory syndrome epidemic.
- Urology training was affected by the dramatic reduction in the number of surgeries performed for benign prostatic hyperplasia and urolithiasis.

Implications for clinical practice or policy

- A prompt infection control response on the hospital level and heightened public awareness of personal hygiene have reduced the risk of infection among medical personnel to a minimal level.
- A prioritisation policy of surgeries and services by malignancy alone during pandemics is worth reconsideration. More detailed differentiation of the urgency of interventions is needed to cover the whole spectrum of diseases, from benign to malignant.

Introduction

In November 2002, there were reports of severe pneumonia of unknown aetiology in Guangdong Province in Southern China, which totalled more than 300 cases by February 2003.¹ The disease was spread to Hong Kong in February 2003 through a visitor from southern China, eventually leading to hospital and community outbreaks.² The World Health Organization (WHO) named the condition severe acute respiratory syndrome (SARS) and issued a global alert and instituted worldwide surveillance on 13 March 2003.³ A novel coronavirus (SARS-CoV) was identified as the causative agent.⁴ The epidemic reached its peak in Hong Kong at the end of March 2003, when the disease was spread to the community, and it was eventually brought under control in May 2003. By the end of the epidemic in July 2003, 8096 cases had been reported in 29 countries and regions, with a death toll of 774 (9.6%).⁵

Seventeen years later, a coronavirus took the world by surprise again. At the end of 2019, a cluster of patients with pneumonia of unidentified cause were reported in Wuhan, China.⁶ The first case of similar pneumonia of unknown aetiology outside China was reported in Thailand on 13 January 2020, and subsequently, the disease struck Hong Kong on 23 January 2020. The novel virus is designated as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), and the standard name of coronavirus disease 2019 (COVID-19) was announced by the WHO to correspond to the pneumonia caused by this novel coronavirus. On 30 January 2020, the WHO declared a 'public health emergency of international concern', and later, on 11 March 2020, COVID-19 was characterised by the WHO as a pandemic.⁷

The impact of COVID-19 affected the whole spectrum of clinical practice, just like it has affected every corner of the world. Although urology does not stand at the forefront of care for patients with COVID-19, every practising urologist has been affected by the global outbreak. Hong Kong is in the unique position of having dealt with two serious coronavirus outbreaks in two decades. The invaluable lessons learnt from SARS in 2003 can help the urology community to face COVID-19 in 2020. The current study aimed to review the territory-wide urology practice in Hong Kong during SARS and COVID-19 from the perspectives of both practising urologists and urology residents in training.

Methods

Hong Kong's healthcare system is divided into a government-run service and a private sector. The public sector dominates secondary and tertiary care, accounting for approximately 80% of all hospital admissions, 90% of total bed-days, and 100% of

嚴重急性呼吸系統綜合症和2019冠狀病毒病大流行對泌尿科醫生臨床實踐和培訓的影響

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引言：根據2003年嚴重急性呼吸系統綜合症（SARS）的經驗，檢視2019冠狀病毒病（COVID-19）大流行期間對泌尿科醫生臨床實踐的影響。

方法：獲取香港公立醫院所有泌尿科於COVID-19大流行期間（2020年2月1日至2020年3月31日）和前一年同期（2019年2月1日至2019年3月31日）的機構數據、以線上匿名調查評估COVID-19對實習醫生培訓的影響，以及以一所大學教學醫院的臨床產量與SARS時期的數據作比較。

結果：在所有檢查的中心中，手術次數、門診就診次數、膀胱鏡檢查次數、前列腺活檢次數和衝擊波碎石術次數分別減少40.5%、28.5%、49.6%、44.8%和38.5%。平均手術次數由COVID-19大流行前的 85.1 ± 30.3 減至COVID-19大流行期間的 50.6 ± 25.7 （ $P=0.005$ ）。所有中心都優先考慮進行與癌症相關的手術。良性前列腺增生相關手術（39.1%）和輸尿管結石手術（25.5%）是最常見的延遲手術。COVID-19大流行期間泌尿科服務的減少幅度較SARS期間為低（後者的手術、膀胱鏡檢查和活檢數量分別減少47.2%、55.3%和70.5%）。實習醫生的平均手術次數由COVID-19大流行之前的 75.4 ± 48.0 減至COVID-19大流行期間的 34.9 ± 17.2 （ $P=0.002$ ）。

結論：研究顯示COVID-19大流行期間對泌尿科醫生各項臨床實踐造成影響。

professional training for doctors.⁸ The current study focused on a comprehensive review of urology practice in Hong Kong's public sector.

This study was approved by the ethics committee of our institution. All 11 urology units in the public sector were included in the review (Table 1). For ease of interpretation, two hospitals were sometimes grouped as a single unit when they provide a comprehensive urology service together. Four areas were investigated to assess the impact of COVID-19 in the urology community: (1) new urology practice strategies introduced; (2) new infection control measures for urologists; (3) training and academic activities; and (4) cross-specialty deployment from urology teams to support COVID-19 frontline staff. With regard to new urology practice strategies and new infection control measures, five aspects of urology services were individually studied: (1) surgery; (2) out-patient clinics; (3) endoscopy; (4) prostate biopsy; and (5) shockwave lithotripsy (SWL).

After COVID-19 spread to Hong Kong at the end of January, the number of new cases rose steadily. A brief surge was observed in March 2020 due to an increase of imported cases before travel restrictions were implemented.⁹ Urology service data from 1 February 2020 to 31 March 2020 were collected from all centres in the public sector to investigate

TABLE 1. Urology centres in Hong Kong

	Catchment area population	No. of urologists	No. of urology residents	Deployment mechanism installed*	Deployment mechanism activated†
PWH	1 414 000	7	3	No	Not applicable
NDH + AHNH		7	1	Yes	No
QMH + TWH	513 700	5	3	No	Not applicable
UCH	1 181 200	3	5	Yes	Yes
TKOH		2	1	Yes	No
TMH + POH	1 203 500	8	3	No	Not applicable
PMH	2 040 900	7	6	Yes	No
CMC		3	2	Yes	No
PYNEH	746 200	4	4	Yes	No
KWH + OLMH	562 000	4	3	No	Not applicable
QEH		8	2	Yes	No

Abbreviations: AHNH = Alice Ho Miu Ling Nethersole Hospital; CMC = Caritas Medical Centre; COVID-19 = coronavirus disease 2019; KWH = Kwong Wah Hospital; NDH = North District Hospital; OLMH = Our Lady of Maryknoll Hospital; PMH = Princess Margret Hospital; POH = Pok Oi Hospital; PWH = Prince of Wales Hospital; PYNEH = Pamela Youde Nethersole Eastern Hospital; QEH = Queen Elizabeth Hospital; QMH = Queen Mary Hospital; TKOH = Tseung Kwan O Hospital; TMH = Tuen Mun Hospital; TWH = Tung Wah Hospital; UCH = United Christian Hospital

* Deployment of urology team members to support other departments during the COVID-19 pandemic

† Whether any members of the urology team had already been deployed to other departments as of 1 April 2020

the impact of COVID-19 on the four previously mentioned areas of urology practice and training. Similar data from 1 February 2019 to 31 March 2019 were captured as a control for comparison. Furthermore, an anonymous online questionnaire was sent to all urology residents to gauge the impact of COVID-19 on training in detail.

The Prince of Wales Hospital was at the forefront of the SARS outbreak in Hong Kong in 2003.² The Hospital's urology service during SARS (ie, 1 March 2003-30 April 2003) was reviewed using institutional data. A control period from 1 March 2004 to 30 April 2004 was adopted for comparison against the urology practice during SARS. Descriptive statistics were used to characterise the demographic data. Continuous variables were described as means, and categorical variables were described as frequencies. Means were compared using *t* tests with statistical significance set at 5%. The SPSS software package (Windows version 22.0; IBM Corp, Armonk [NY], United States) was used for analysis.

Results

The review covered 11 urology units encompassing the urology practice of 15 hospitals in Hong Kong that serve a population of 7.5 million (Table 1).¹⁰ All of the investigated urology units have reduced their numbers of operating sessions (Fig 1). The first hospital began to reduce surgeries on 27 January 2020, only 4 days after the first COVID-19 case was confirmed in Hong Kong. Across all urology units,

the mean numbers of operating sessions before the COVID-19 pandemic (1 Feb 2019–31 March 2019) and during the COVID-19 pandemic (1 Feb 2020–31 March 2020) were 85.1±30.3 and 50.6±25.7, respectively (*P*=0.005). All urology units have given priority to cancer or cancer-related surgeries. The most commonly delayed type of surgery during the COVID-19 pandemic was benign prostatic hyperplasia-related surgery, accounting for 39.1% of all delayed cases, followed by ureteric stone surgery (25.5%). In addition, all living-related transplant surgeries were suspended during the COVID-19 pandemic period.

All five aspects of urology services have been reduced in the territory (Fig 2). The numbers of operating sessions, clinic attendance, cystoscopy sessions, prostate biopsies, and SWL cases were reduced by 40.5%, 28.5%, 49.6%, 44.8%, and 38.5%, respectively across all of the reviewed centres.

Table 2 summarises the practice changes in the urology units. These included special attention to patients with TOCC (travel, occupation, contact, and cluster history) risk of COVID-19 infection. These patients were either deferred in their hospital attendance or were assessed by a dedicated group of medical personnel so as to achieve efficient use of personal protective equipment (PPE). Teleconsultation was available in one of the centres for urologists to carry out clinical consultations with TOCC-positive patients. Most urologists executed their clinical duties wearing regular surgical masks. Only one urology centre used N95 respirators in

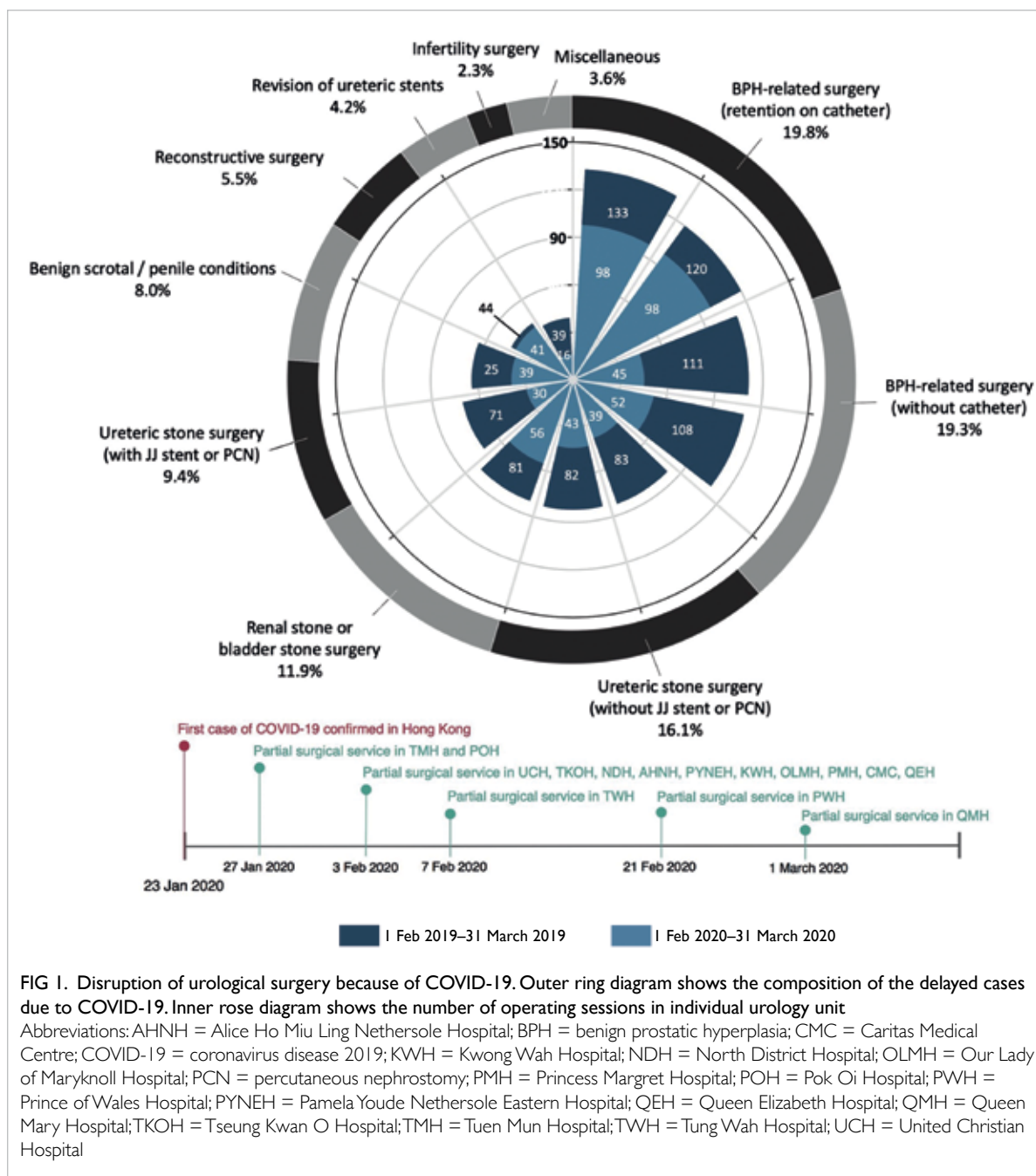
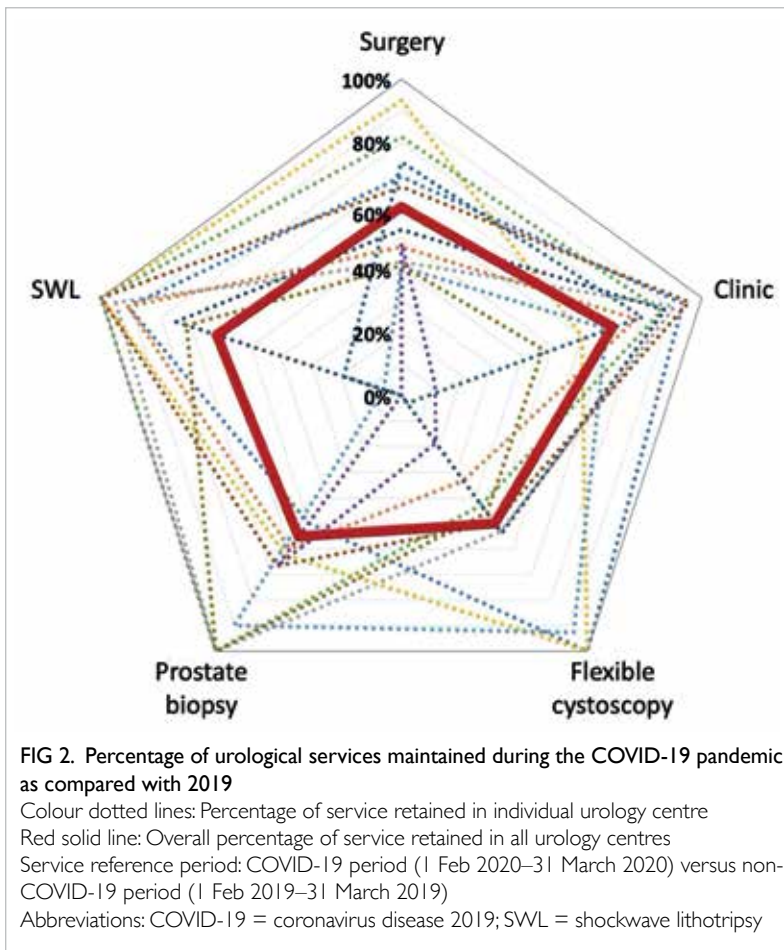


FIG 1. Disruption of urological surgery because of COVID-19. Outer ring diagram shows the composition of the delayed cases due to COVID-19. Inner rose diagram shows the number of operating sessions in individual urology unit
 Abbreviations: AHNH = Alice Ho Miu Ling Nethersole Hospital; BPH = benign prostatic hyperplasia; CMC = Caritas Medical Centre; COVID-19 = coronavirus disease 2019; KWH = Kwong Wah Hospital; NDH = North District Hospital; OLMH = Our Lady of Maryknoll Hospital; PCN = percutaneous nephrostomy; PMH = Princess Margret Hospital; POH = Pok Oi Hospital; PWH = Prince of Wales Hospital; PYNEH = Pamela Youde Nethersole Eastern Hospital; QEH = Queen Elizabeth Hospital; QMH = Queen Mary Hospital; TKOH = Tseung Kwan O Hospital; TMH = Tuen Mun Hospital; TWH = Tung Wah Hospital; UCH = United Christian Hospital

clinical practice, specifically for prostate biopsy. A comparison of urology services in Prince of Wales Hospital between the COVID-19 pandemic in 2020 and the SARS period in 2003 is shown in Figure 3. There was less reduction in all aspects during COVID-19 than during SARS (operating sessions: 30.9% vs 47.2%; cystoscopy: 27.7% vs 55.3%; prostate biopsy: 47.6% vs 70.5%; SWL: 13.9% vs 23.6%). The percentage reductions of different urology services during the COVID-19 pandemic in Prince of Wales Hospital were all less than those during the SARS period in 2003. The absolute urology output during SARS actually exceeded that during the 2004 non-

SARS normal time in some areas, including flexible cystoscopy and SWL cases. Training and academic activities were heavily affected by the COVID-19 pandemic (online supplementary Appendix). The survey of urology residents yielded a response rate of 48.5% (16/33). Surgical exposure was significantly hampered, and 53.3% of the respondents had their professional examinations cancelled because of COVID-19, resulting in delays in their acquisition of professional qualifications. Three out of the 11 centres reported having switched some of their academic meetings to online platforms.



Discussion

The most obvious impact of COVID-19 on urology practice has been the reduction of different aspects of urology service. The deliberate reduction of various surgeries and out-patient investigation sessions carries a twofold intention. Besides attempting to minimise infection risk via reduction of patient flow in hospital clinical areas, such actions were also a response to the worldwide crisis of PPE shortage.¹¹ By providing limited service, especially with regard to the availability of general anaesthetic sessions for surgery, it is hoped that adequate PPE can be reserved for frontline staff members who have to handle patients with COVID-19.

Risk assessment based on quantifiable criteria is essential in the selection of patients whose surgical or investigative procedures are to be deferred. All centres adopted prostate-specific antigen (PSA) level as a guideline for rearranging prostate biopsy priority. Chiu et al¹² demonstrated that a Prostate Health Index cut-off of 35 produced a high-grade prostate cancer detection sensitivity of 82% and specificity of 74%. Its diagnostic performance is superior to that of PSA, PSA density, and free-to-total PSA ratio) among patients with PSA values of

2 to 20 ng/mL. When its usage is more widely accepted by the urology community in practice, it could provide useful guidance in prioritising patients for prostate biopsy when resources are limited.

Most centres in the study reserved operating sessions for cancer cases or complicated stones. This is largely in line with the recommendation of Stensland et al¹³, who suggested that uncomplicated endourology procedures, reconstructive surgeries, transplant surgeries, and andrological interventions be delayed. A similar perspective was endorsed by the European Association of Urology.¹⁴ Subcategorisation of urological cancer surgeries is necessary because of the wide spectrum of cancer behaviour within the specialty.^{13,14} High-grade bladder cancer, advanced kidney cancer, and testicular cancer should take priority for operations, whereas most prostatectomies for prostate cancer should be delayed. In the current review, no differentiation was assigned to hospital policies of prioritising cancer surgery. Delays in interventions for other benign conditions could ultimately increase the risk of complications and unscheduled hospital admissions. Nevo et al¹⁵ reported that prolonged stent dwelling time was a risk factor for postoperative sepsis. Prospective assessment is needed to evaluate our current surgery triage protocol.

There are still conflicting opinions regarding the risk of SARS-CoV-2 transmission during laparoscopic and robotic surgery. The SARS-CoV-2 virus can remain viable and infectious in aerosols for hours,¹⁶ but respiratory aerosol-generating procedures seem to have a higher viral content and thus pose a greater risk of transmission than surgical aerosol-generating procedures that aerosolise blood and tissue fluid.¹⁷ The EAU Robotic Urology Section recommended that laparoscopic and robotic surgeries proceed with the necessary precautions.¹⁸ In all of the centres reviewed in the study, laparoscopic and robotic surgeries were executed with conventional infection control protocols. Thus far, no COVID-19 cases have been reported to be transmitted via laparoscopic or robotic surgery.

With respect to the PPE used, regular use of face shields or goggles was not observed in most centres. Evidence so far has shown that besides the respiratory system, SARS-CoV-2 can infect the digestive system and the urinary system, causing the virus to be found in the stool and urine.¹⁹ Ling et al²⁰ reported COVID-19 cases in which urine samples remained positive even after throat swabs had converted negative. A similar observation about stool was reported by Chen et al,²¹ who found that 64.29% of patients tested positive for viral RNA in faeces after pharyngeal swabs turned negative. As asymptomatic COVID-19 patients have been reported,²² and contact with urine and stool during urological procedures is not uncommon, the

TABLE 2. Changes to urology practice in response to the COVID-19 pandemic

Urology service	Responses to COVID-19	Practice change	Units adopting the practice
Surgery	New modifications to clinical system	1. Reduction of available elective operation sessions	100%
		2. Delaying elective operations except cases in the following categories:	
		a. Confirmed cancer cases	100%
		b. Suspected cancer cases	100%
		c. Ureteric stones with or without ureteric stent/nephrostomy tube	72.7%
		d. Benign prostatic obstruction for which weaning off urethral catheter has failed	18.2%
		e. Tenckhoff catheter insertion	18.2%
3. Increased preference for SA to GA as the anaesthetic mode	63.6%		
4. Testing selected TOCC-negative patients' COVID-19 status	45.5%		
5. Delaying elective operations if patients are TOCC-positive	36.4%		
6. Testing the patient's COVID-19 status prior to surgery if patients are TOCC-positive	27.3%		
7. Cancelling all local anaesthetic operations	27.3%		
Surgery	Additional infection control precautions	1. Using face shields or goggles	36.4%
		2. Minimising the number of surgeons in the operating theatre	27.3%
Clinic	New modifications to clinical system	1. Allowing patients to come to the clinic and refill their prescriptions without medical consultation to minimise their exposure in the hospital	100%
		2. Checking patients' body temperature and TOCC before they enter the clinic	100%
		3. Delaying relatively non-urgent cases (voiding dysfunction, non-obstructive stones, benign renal lesions, andrology cases, chronic pelvic pain syndrome) to have follow-up after COVID-19 pandemic	18.2%
		4. Availability of teleconsultation room	9.1%
Clinic	Additional infection control precautions	1. Wearing surgical masks during consultation	100%
Flexible cystoscopy	New modifications to clinical system	1. Reduction of available elective cystoscopy sessions	81.8%
		2. Delaying elective cystoscopy cases, except cases in the following categories:	
		a. Microscopic haematuria	72.7%
		b. Bladder cancer surveillance cystoscopy	63.6%
		c. Suspected bladder stones	63.6%
		d. Gross haematuria	9.1%
		1. Changing PPE for each consecutive cystoscopy case	18.2%
2. Using face shields or goggles	18.2%		
Prostate biopsy	New modifications to clinical system	1. Reduction of available elective biopsy sessions	63.6%
		2. Delaying the following cases until after the COVID-19 pandemic:	
		a. PSA <10 ng/mL	45.5%
		b. PSA <15 ng/mL	18.2%
		c. PSA <20 ng/mL	27.3%
		d. Patients with prostate cancer on active surveillance	36.4%
		1. Using face shields or goggles	18.2%
2. Using N95 respirators	9.1%		
3. Changing PPE for each consecutive biopsy case	9.1%		
SWL	New modifications to clinical system	1. Delaying the following cases until after the COVID-19 pandemic:	
		a. Renal stones	81.8%
		b. Ureteric stones with ureteric stent/nephrostomy tube	27.3%
2. Reduction of available elective SWL sessions	27.3%		

Abbreviations: COVID-19 = coronavirus disease 2019; GA = general anaesthesia; PPE = personal protective equipment; PSA = prostate-specific antigen; SA = spinal anaesthesia; SWL = shockwave lithotripsy; TOCC = travel, occupation, contact, and cluster history

optimal standard of PPE for urologists needs further consideration.

We observe that the surveyed residents' training and academic activities were affected by the current pandemic. Furthermore, there may be a preference for surgical interventions to be performed by more experienced surgeons so as to reduce the operating time.²³ In addition, most of the delayed cases during this COVID-19 pandemic were endourology cases (Fig 1), which account for the

main bulk of urology resident training materials. A similar observation was echoed by urology residents in Italy.²⁴

The outbreak of SARS in 2003 marked a critical turning point in Hong Kong. Invaluable lessons were learnt, including improvements in infection control measures and more rapid response. The public has perceived face masks as a tool for preventing infection both during the SARS outbreak and in the post-SARS era.²⁵ Lau et al²⁶

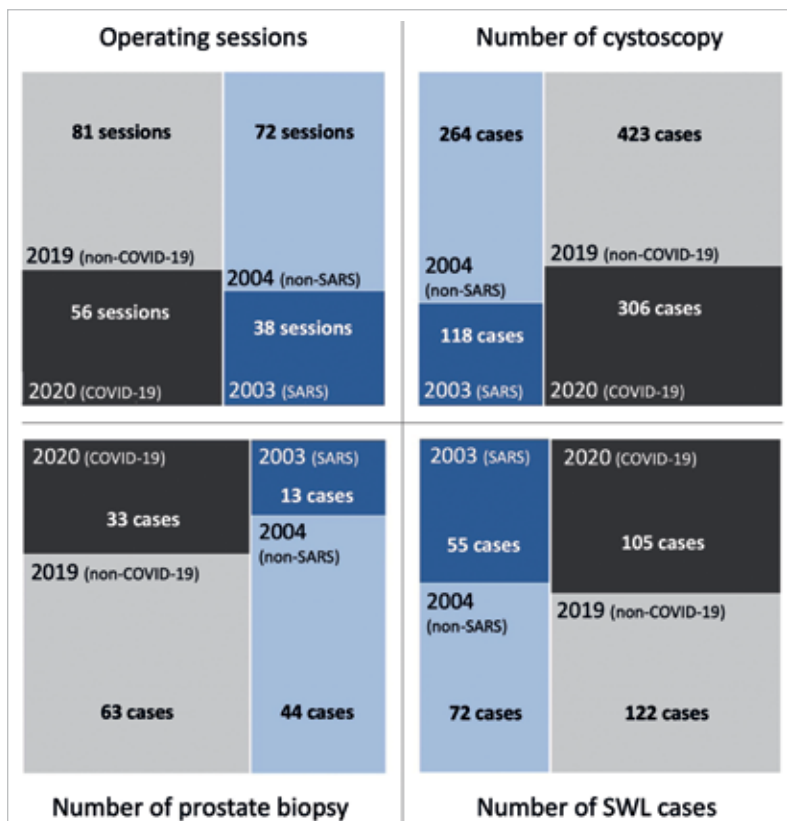


FIG 3. TreeMap of urology services in Prince of Wales Hospital during the SARS epidemic (1 Mar 2003–30 Apr 2003) compared with a comparable non-SARS period (1 Mar 2004–30 Apr 2004), and during the COVID-19 epidemic (1 Feb 2020–31 Mar 2020) compared with a comparable non-COVID-19 period (1 Feb 2019–31 Mar 2019)

Abbreviations: SARS = severe acute respiratory syndrome; SWL = shockwave lithotripsy

reported that 70.7% of the respondents to a survey in Hong Kong would frequently wear masks, 67.3% would avoid going to hospitals, and 71.5% would avoid going to crowded places if a few new SARS cases were reported. Further, healthcare workers have developed good infection control habits (eg, hand hygiene precautions and appropriate PPE selection).⁸ These elements all contributed to the multi-faceted strategies of different institutions' urology departments when they were confronted by COVID-19 in 2020. The current study revealed that measures to minimise the infection risk were adopted in the very early phase of COVID-19 emergence. All of the investigated urology centres have reorganised their services to decrease patient flow and reduce the risk of mass gathering. Together with the heightened public awareness of personal hygiene, these factors could assist with containment of infection. Taking Prince of Wales Hospital as an example, the clinical output of minimal services during the COVID-19 pandemic was still higher than that in 2004 during the post-SARS period. This pattern is expected to be similar in other major urology centres in Hong Kong

considering the growth in population and service need. However, no hospital outbreaks of COVID-19 have been observed so far in Hong Kong, unlike during SARS, and unlike a number of centres in other parts of the world during COVID-19. The experience of SARS in Hong Kong might have inadvertently prepared medical personnel across all specialties in our locality to face this COVID-19 pandemic with a more timely and comprehensive reaction.

A limitation of our study is that we did not investigate behaviour in the private sector. However, the public sector accounts for about 70% of hospital-based services provided in Hong Kong,²⁷ and thus, it is reasonable to interpret the current study as a meaningful representation of urology practice across the whole city during the COVID-19 pandemic.

Conclusion

Our study on urology practice reviewed the impact of COVID-19 from a metropolitan-city-wide perspective. The unique experience of the SARS outbreak in 2003 prepared Hong Kong in an unusual way to face the current pandemic of COVID-19. Changes to every aspect of urology practice were observed. Rapid responses from surgical teams in concert with the efforts from different specialties in the medical field have minimised the risk of outbreaks in hospitals and institutions. Prospective studies are needed to review the outcomes of these changes to urology practice.

Author contributions

CH Yee and CF Ng contributed to the concept of the study. CH Yee contributed to the analysis and interpretation of data, and drafting of the manuscript. All authors contributed to the acquisition of data and critical revision for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

As editors of the journal, JYC Teoh and CF Ng were not involved in the peer review process. Other authors have disclosed no conflicts of interest.

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Ethics approval

The study was approved by the ethics committee of our institution's Survey and Behavioural Research Ethics board (Ref SBRE-19-563).

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