Infections

Risk Assessment and Prevention of Severe Acute Respiratory Syndrome Coronavirus 2 Transmission for Hospitalized Urological Patients After the COVID-19 Pandemic in Wuhan, China

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**Abstract**

**Background:** Emerging asymptomatic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections were detected and multiple cases were found to be SARS-CoV-2 positive again, which raised an alarm for the patients hospitalized after the coronavirus disease 2019 (COVID-19) pandemic.

**Objective:** We investigated the risk and prevention of hospital transmission of SARS-CoV-2 to hospitalized urological patients.

**Design, setting, and participants:** This is a retrospective study of 319 hospitalized urological patients enrolled between April 20, 2020 and May 11, 2020 from two tertiary hospitals in Wuhan, China.

**Intervention:** Chest computed tomography (CT) images, nucleic acid tests (NATs), and serum antibody were examined at the outpatient department and 1 wk after admission for all patients.

**Outcome measurements and statistical analysis:** The chest CT images, NATs, serum antibody results, and clinical data were collected and analyzed.

**Results and limitations:** None of the 319 patients was found to be SARS-CoV-2 NAT positive. Ten and four patients were detected to be immunoglobulin (Ig)G and IgM positive, respectively. The chest CT features of 116 patients showed abnormal lung findings. During the 1-wk isolation, one patient initially being IgG positive only was found to be IgM positive, and another initially IgM-positive patient had a rising IgG level. Through risk assessment, we identified seven patients with very high and high risk for hospital transmission, and delayed the surgery while maintaining close follow-up. Five intermediate-risk patients were operated on successfully under paravertebral block or epidural anesthesia to avoid opening the airway with endotracheal intubation. The remaining 104 low-risk and 203 normal patients underwent normal surgery.

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http://dx.doi.org/10.1016/j.euros.2020.07.004
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**Conclusions:** Of the 319 patients, seven were identified as very high and high risk, which reinforced the importance of epidemic surveillance of discharged COVID-19 patients and asymptomatic infections. Five intermediate-risk patients were operated on successfully under regional anesthesia.

**Patient summary:** Our experience of risk assessment and management practice may provide a strategy to prevent severe acute respiratory syndrome coronavirus 2 transmission to hospitalized urological patients after the coronavirus disease 2019 (COVID-19) pandemic.

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1. **Introduction**

With its rapid spread, coronavirus disease 2019 (COVID-19) has caused widespread concern all over the world and was declared a pandemic on March 11, 2020 by the World Health Organization (WHO) [1]. The Chinese city of Wuhan, the epicenter of the COVID-19 early outbreak, has been reversed successfully by social distancing and lockdown for 76 d. Now life is returning to normal and standard health care services are resuming slowly.

The positive result of nucleic acid tests (NATs) is the current gold standard to confirm severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, but the diagnostic accuracy is reported to range from 30% to 50%, which remains controversial [2,3]. For the current COVID-19 pandemic, there have been several reports of false negative results for people who are actually infected with SARS-CoV-2. Many suspected patients exhibited typical clinical symptoms or imaging features consistent with pneumonia, but were not found to be positive by NATs [4]. False negative NAT results of these patients raised a concern.

Asymptomatic people are defined as those who carry the active SARS-CoV-2 virus in their body but show no related symptoms. Chinese researchers suggested that up to 25% of those who become infected with the novel coronavirus may not show symptoms [5]. Mizumoto et al [6] estimated that the asymptomatic proportion of infections was 17.9% in Yokohama, Japan. The high percentage of SARS-CoV-2–infected yet asymptomatic people could contribute to the spread of the coronavirus across the world, if they are not detected.

SARS-CoV-2 RNA from respiratory tract specimens may be sustained and become positive again during the course of COVID-19. Emerging evidence has found the recurrence of positive SARS-CoV-2 RNA in discharged patients [7]. Yao et al [8] performed a postmortem pathological study in a 78-yr-old ready-for-discharge COVID-19 patient who unfortunately died from sudden cardiac arrest and revealed that SARS-CoV-2 viruses remained in pneumocytes.

The false negative results of NATs, existence of asymptomatic transmission, and multiple cases being positive again among discharged or ready-for-discharge COVID-19 patients raised concerns for the hospitalized patients who were scheduled for urological surgery after the COVID-19 pandemic in Wuhan. Here, we investigated the risk and prevention of hospital transmission of SARS-CoV-2 to urological patients, while preparing for a second wave of COVID-19.

2. **Patients and methods**

2.1. **Study design and participants**

We conducted a retrospective review of hospitalized urological patients from two tertiary hospitals in Wuhan: Tongji Hospital (Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology) and TCM Hospital (Hubei Provincial Hospital of Traditional Chinese Medicine). For all enrolled patients, demographic information, history of COVID-19, epidemiology, clinical data, chest computed tomography (CT) scan findings, NAT results, and immunoglobulin (Ig)M and IgG antibodies from the outpatient setting to hospital admission were obtained from the clinical records. All patients with suspected or confirmed COVID-19 were diagnosed based on the Diagnosis and treatment protocol for novel coronavirus pneumonia (seventh edition), published by the National Health Commission and State Administration of Traditional Chinese Medicine.

2.2. **Chest CT examination and CT review**

A total of 319 urological patients were enrolled from April 20, 2020 to May 11, 2020. CT (CT HD750 Discovery; GE) examination follows the common chest CT scan protocol. Two certificated chest CT radiologists with 5–10 yr of experience independently reviewed the CT images while they were blinded to the clinical information of the patients.

2.3. **Nucleic acid tests**

Upper respiratory tract samples, including nasopharyngeal and oropharyngeal swab, were collected from all the patients. SARS-CoV-2 open reading frame 1ab(ORF1ab)/nucleocapsid protein (N) gene was detected by quantitative reverse transcription polymerase chain reaction (qRT-PCR) using the double nucleic acid detection kit (BioGerm, Shanghai, China), following WHO guidelines [9,10].

2.4. **Antibody measurement**

The IgG and IgM antibodies against SARS-CoV-2 in serum samples were detected using a sandwich enzyme-linked immunosorbent assay (ELISA) kit following the manufacturer’s instructions. The levels of IgG and IgM antibodies were positively correlated with the relative luminescence
unit and were expressed in arbitrary units per milliliter (AU/mL). Any test showing an IgG/IgM result of >10 AU/mL was considered positive.

### 2.5. Statistical analysis

Continue variables were described as mean ± standard deviation for normal distribution data or as median with interquartile range for non-normal distribution data. Categorical variables were expressed as numbers (%). Paired Student t tests were used to analyze group differences. Two-sided p values of <0.05 were considered statistically significant. SPSS version 21.0 (SPSS Inc., Chicago, IL, USA) and Prism 7 (GraphPad, La Jolla, CA, USA) were used to analyze the data.

### 2.6. Ethical approval

Ethical approval was exempted by the hospital institutional review board, since we collected and analyzed all the data from patients according to the policy for public health outbreak investigation of emerging infectious diseases issued by the National Health Commission of China.

### 3. Results

#### 3.1. Demographics and clinical characteristics

A total of 319 hospitalized urological patients were included in this study: 172 (53.9%) from Tongji Hospital and 147 (46.1%) from TCM Hospital. The mean age of the study participants was 52.24 ± 15.09 yr; there were 233 (73.0%) males and 86 (27.0%) females. All the patients had an epidemiological history exposure to COVID-19. Most of the patients in this study were people without a previous history of COVID-19; only one patient with mild COVID-19 was treated and discharged in the makeshift hospital after two NATs were negative. Eleven (3.45%) patients had fever or respiratory symptoms. In all, 187 (58.6%) patients are Wuhan citizens, 121 (37.9%) are from other cities in Hubei province, and 11 (3.45%) are from outside of Hubei. Of the 319 patients, 116 (36.4%) were reported to have abnormal findings in the lung CT scan. Of the patients, 3.13% (10/319) were positive with IgG and 1.25% (four/319) were positive with IgM. The baseline demographic information and clinical characteristics are shown in Table 1.

#### 3.2. Changes in the spectrum of urological disorders

Compared with the same period in the previous year, there was a 44.4% reduction in the total number of hospitalized urological patients. For the changes in the spectrum of urological disorders, a significant increase was shown in urogenital cancer patients (p = 0.03) and those with nonfunctional kidneys with hydrenephrosis (p = 0.02). While there was a significant decrease in endoscopic interventions for stone disease (p = 0.03) and endoscopic surgery in transurethral resection of the prostate (TURP; p = 0.04), there was no change in the proportion of other urological diseases over the study period (Table 2).

### 3.3. Chest CT, NATs, and IgM and IgG antibody detection

All patients had a negative result in the NATs; 116 patients showed abnormal findings in the lung CT scan, including 55 patients with the appearance of ground-glass opacities or patch features, defined as chest CT (+), and 61 patients with lung fibrotic streak changes, defined as chest CT (+). Among the 55 chest CT (+) patients who were tested for serological antibodies, three were positive for both antibodies, one was positive for IgM only, three were positive for IgG only, and 48 were negative for both antibodies. Among the 61 chest CT (+) patients, none was positive for both antibodies or for IgM only, five were positive for IgG only, and 56 were negative for both antibodies. All the 203 chest CT (−) patients were negative for both antibodies. A further subgroup analysis was performed based on the chest CT findings, NATs, and IgM and IgG antibody detection (Table 3).

### 3.4. Risk assessment and surgery management

To predict who is at a high risk of hospital transmission during the urological surgery, we propose a risk classification system that evaluates the risk of SARS-CoV-2 transmission for hospitalized patients (Table 4). According to the risk definitions, the patients were classified into five groups: very-high,
Table 2 – Changes in the types of urological diseases compared with the same period of the previous year.

| Disease                        | April 20, 2020–May 11, 2020 | April 20, 2019–May 11, 2019 | p value |
|--------------------------------|-----------------------------|-----------------------------|---------|
| Cancer                         | 113/319 (35.4)              | 164/574 (28.6)              | 0.03    |
| Renal cancer                   | 29/319 (9.1)                | 42/574 (7.3)                |         |
| Ureteral cancer                | 8/319 (2.5)                 | 12/574 (2.1)                |         |
| Bladder cancer                 | 42/319 (13.2)               | 63/574 (11.0)               |         |
| Prostate cancer                | 32/319 (10.0)               | 46/574 (8.0)                |         |
| Penile cancer                  | 2/319 (0.6)                 | 1/574 (0.2)                 |         |
| Adrenal tumor                  | 31/319 (9.7)                | 47/574 (8.2)                | 0.44    |
| Renal cyst                     | 4/319 (1.25)                | 11/574 (1.9)                | 0.46    |
| Hydronephrosis with ureteral stricture | 39/319 (12.2)            | 44/574 (7.7)                | 0.02    |
| Stone                          | 103/319 (32.3)              | 227/574 (39.5)              | 0.03    |
| Kidney stone                   | 40/319 (12.5)               | 89/574 (15.5)               |         |
| Kidney-ureteral stone          | 38/319 (11.9)               | 72/574 (12.5)               |         |
| Ureteral stone                 | 20/319 (6.3)                | 55/574 (9.6)                |         |
| Bladder stone                  | 5/319 (1.6)                 | 11/574 (1.9)                |         |
| BPH                            | 17/319 (5.3)                | 53/574 (9.2)                | 0.04    |
| Others                         | 12/319 (3.8)                | 29/574 (5.1)                | 0.38    |
| Renal tuberculosis             | 2/319 (0.6)                 | 4/574 (0.7)                 |         |
| Urethral stricture             | 2/319 (0.6)                 | 5/574 (0.9)                 |         |
| Stress incontinence            | 2/319 (0.6)                 | 8/574 (1.4)                 |         |
| Varicocele                     | 2/319 (0.6)                 | 5/574 (0.9)                 |         |
| Hydrocele                      | 1/319 (0.3)                 | 4/574 (0.7)                 |         |
| Azooospermia                   | 1/319 (0.3)                 | 2/574 (0.3)                 |         |
| Testicular torsion             | 1/319 (0.3)                 | 1/574 (0.2)                 |         |

Data are presented as n/N (%).
BPH = benign prostate hyperplasia.

In total, three (0.94%), four (1.25%), five (1.57%), and 104 (32.6%) of the 319 patients scheduled for the urological surgery were at a very high, high, intermediate, and low risk of hospital transmission according to our categorization (Table 5). During the 1-wk isolation in the observation ward, one patient who was initially IgG positive only became IgM positive also, escalating to very high risk from high risk, while another initially IgM-positive patient had a rising IgG level (Table 5). By risk assessment, we identified seven patients with very high and high risk for hospital transmission, and delayed the surgery while maintaining close follow-up (Table 6). Five intermediate-risk patients were operated successfully under regional block anesthesia, including paravertebral block or epidural anesthesia, to avoid opening the airway with endotracheal intubation (Table 7). The remaining 104 low-risk and 203 normal patients underwent normal surgery (Table 5).

4. Discussion

Wuhan was the epicenter of the COVID-19 outbreak, and now life is gradually returning to normal after lockdown for 76 d [11]. In a recent study, Luciani et al [12] described the risk of COVID-19 in a COVID-free urology unit. In the present study, we comprehensively investigated the risk assessment and management practice to provide strategies to prevent SARS-CoV-2 transmission for hospitalized urological patients after the COVID-19 pandemic in Wuhan.

?A3B2 twb=35w?Owing to the lockdown, accumulating urogenital cancer patients are in urgent need of treatment because the disease is life threatening. Chronic hydronephrosis if not treated may finally lead to nonfunctional kidneys, requiring surgical intervention. However, there was a significant decrease in endoscopic interventions for stone disease and endoscopic surgery in TURP [13]. Many of these diseases are chronic in nature and affect individuals not only by shortening their survival, but also by impairing their quality of life [14]. Some of these patients preferred conservative treatment during the COVID-19 pandemic.

Currently, RT-PCR–based SARS-CoV-2 viral RNA detection is the standard to diagnose COVID-19 in clinical practice. However, the reported positive rate varied from 30% to 50% for different swab specimens in COVID-19 patients. Many cases that were strongly epidemiologically linked to SARS-CoV-2 exposure and with typical lung CT findings still remained NAT negative in their upper respiratory tract samples [15,16]. Emerging evidence has found more and more cases of asymptomatic SARS-CoV-2 infections being detected and discharged COVID-19 patients turning positive again [5,7].

The serological antibodies against SARS-CoV-2 could be detected in the middle and later stage of the disease course. IgM and IgG antibody tests have shown great specificity for the diagnosis of COVID-19 [17]. Compared with RT-PCR, serological detection has advantages with faster turnaround time, high throughput, and less workload to function as a crucial complement approach for NATs [17,18]. Evidence demonstrated that the median time of seroconversion was 11 d for IgG and 14 d for IgM after disease onset [19]. IgM antibody appeared within 7 d after SARS-CoV-2 infection, and

high-, intermediate-, low-, and normal-risk groups. Very high-risk individuals are defined as those with NAT (+) or IgM (+). High-risk individuals are defined as those with NATs (−), IgG (+), IgM (−), and chest CT showing abnormal lung findings consistent with the radiographic features of COVID-19 infection stage, or those with a history of SARS-CoV-2 infection, NATs (−), IgG (−), IgM (−), and chest CT showing abnormal lung findings consistent with the radiographic features of COVID-19 infection stage. Intermediate-risk individuals are defined as those with NATs (−), IgG (+), IgM (−), and chest CT showing abnormal lung findings consistent with the radiographic features of COVID-19 convalescence stage, or those with a history of SARS-CoV-2 infection, NATs (−), IgG (−), IgM (−), and chest CT showing abnormal lung findings consistent with the radiographic features of COVID-19 convalescence stage. Low-risk individuals are defined as those with NATs (−), IgG (+), IgM (−), and chest CT showing normal lung findings; those with a history of SARS-CoV-2 infection, NATs (−), IgG (−), IgM (−), and chest CT showing normal lung findings; or those without a history of SARS-CoV-2 infection, NATs (−), IgG (−), IgM (−), and chest CT showing abnormal lung findings. The normal individuals are defined as patients without a history of SARS-CoV-2 infection, NATs (−), IgG (−), IgM (−), and chest CT showing normal lung findings. For the very high- and high risk patients, we recommended delaying the surgery and closely following the NATs, IgG, IgM, and chest CT changes. For emergency surgery, dedicated COVID-19 OR/ward facilities should be provided. For the intermediate-risk patients, we recommended regional block anesthesia to avoid general anesthesia with endotracheal intubation (Fig. 1).
Table 3 – Chest CT, SARS-CoV-2 nucleic acid test, and IgM and IgG antibody detection of 319 hospitalized urological patients after the COVID-19 pandemic in Wuhan.

| Nucleic acid test (-) | Chest CT scan<sup>a</sup> | IgG | IgM | Total | Tongji Hospital | TCM Hospital |
|-----------------------|---------------------------|-----|-----|-------|----------------|-------------|
| Chest CT (+++)        | IgG (+) IgM (+) 3/319 (0.94) 2/172 (1.16) 1/147 (0.68) |
| Chest CT (+)          | IgG (-) IgM (+) 1/319 (0.31) 0 1/147 (0.68) |
|                       | IgG (+) IgM (-) 3/319 (0.94) 3/172 (1.74) 0 |
|                       | IgG (-) IgM (-) 48/319 (15.0) 22/172 (12.8) 26/147 (17.7) |
| Chest CT (-)          | IgG (+) IgM (+) 0 0 0 |
|                       | IgG (-) IgM (+) 0 0 0 |
|                       | IgG (+) IgM (-) 5/319 (1.57) 3/172 (1.74) 2/147 (1.36) |
|                       | IgG (-) IgM (-) 56/319 (17.56) 36/172 (20.9) 20/147 (13.6) |
|                       | IgG (+) IgM (-) 0 0 0 |
|                       | IgG (-) IgM (-) 0 0 0 |
|                       | IgG (+) IgM (-) 203/319 (63.6) 106/172 (61.6) 97/147 (66.0) |

Data are presented as n/N (%).

COVID-19 = coronavirus disease 2019; CT = computed tomography; IgG = immunoglobulin G; IgM = immunoglobulin M; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

<sup>a</sup> Chest CT (+) was defined as the appearance of ground-glass opacities or patch features; chest CT (+) was defined as finding of lung fibrotic streak changes; and chest CT (-) was defined as normal findings in the lung CT scan.

Table 4 – Risk definition, assessment, and prevention of SARS-CoV-2 transmission for hospitalized urological patients after the COVID-19 pandemic in Wuhan.

| Risk grade     | Risk definitions                                                                 | Surgical management                                                                 |
|----------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Very high risk | Satisfy either of the following two:                                            | For emergency surgery, dedicated COVID-19 OR/ward facilities; for elective surgery,  |
|                | 1. Nucleic acid test (+)                                                          | delaying the surgery and close follow-up depending on the nucleic acid test, IgG, IgM,  |
|                | 2. IgM (+)                                                                        | and chest CT changes                                                                 |
| High risk      | Satisfy either of the following two:                                            | Try to avoid general anesthesia with endotracheal intubation, select epidural,       |
|                | 1. Nucleic acid test (-), IgG (+), IgM (-), and chest CT showed abnormal lung     | lumbar, paravertebral block, and intravenous or local anesthesia                     |
|                | findings consistent with the radiographic features of COVID-19 infection stage<sup>a</sup> |                                                                                      |
|                | 2. History of SARS-CoV-2 infection, nucleic acid test (-), IgG (-), IgM (-), and |                                                                                      |
|                | chest CT showed abnormal lung findings consistent with the radiographic features |                                                                                      |
|                | of COVID-19 convalescence stage                                                   |                                                                                      |
| Intermediate   | Satisfy either of the following two:                                            | Normal surgery                                                                      |
| risk           | 1. Nucleic acid test (-), IgG (+), IgM (-), and chest CT showed abnormal lung     |                                                                                      |
|                | findings consistent with the radiographic features of COVID-19 convalescence     |                                                                                      |
|                | stage                                                                            |                                                                                      |
| Low risk       | Satisfy any of the following three:                                             |                                                                                      |
|                | 1. Nucleic acid test (-), IgG (+), IgM (-), and chest CT showed normal lung       |                                                                                      |
|                | findings                                                                           |                                                                                      |
|                | 2. History of SARS-CoV-2 infection, nucleic acid test (-), IgG (-), IgM (-), and |                                                                                      |
|                | chest CT showed normal lung findings                                              |                                                                                      |
|                | 3. No history of SARS-CoV-2 infection, nucleic acid test (-), IgG (-), IgM (-), |                                                                                      |
|                | and chest CT showed abnormal lung findings                                        |                                                                                      |
| Normal         | No history of SARS-CoV-2 infection, nucleic acid test (-), IgG (-), IgM (-), and  |                                                                                      |
|                | chest CT showed normal lung findings                                              |                                                                                      |

COVID-19 = coronavirus disease 2019; CT = computed tomography; IgG = immunoglobulin G; IgM = immunoglobulin M; OR = operating room; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

<sup>a</sup> The chest CT features of COVID-19 pneumonia infection stage included lung changes (ground-glass opacities [GGOs], consolidation, GGO plus a reticular pattern, vascular sign, microvascular dilation sign, a subpleural line, and a subpleural transparent line), bronchial changes (air bronchogram and bronchus distortion), and pleural changes (pleural thickening, pleural retraction sign, and pleural effusion).

<sup>b</sup> The chest CT features of COVID-19 pneumonia convalescence stage included lung changes (fibrotic streaks).

It was present in the body for 1 mo or even longer and then gradually decreased [20]. Our data indicated that antibody detection for hospitalized urological patients could be important as a complement to NATs for the diagnosis of suspected cases with false negative results and in dynamic surveying for the follow-up of very high- and high-risk patients [21].

The Anesthesia Patient Safety Foundation demonstrates that the highest risk of the SARS-CoV-2 virus aerosolization is during intubation and extubation during procedures that require general anesthesia [22]. The American Society of Anesthesiologists also states that laryngeal mask airway may actually increase the risk of SARS-CoV-2 virus aerosolization in the setting of high airway pressure and leakage around the mask [23]. Moreover, monitored anesthesia care, although it avoided intubation and extubation, may require the anesthesia provider to be closer to the patient’s airway, and thus the provider may be at a greater risk if there is a problem requiring manual bagging or unplanned intubation [24]. In particular, through minimizing the many aerosol-generating procedures,
such as bag mask ventilation, open airway suctioning, and endotracheal intubation performed during general anesthesia, anesthesiologists could reduce the risk of exposure of healthcare staff and other patients to patients’ respiratory secretions and perioperative viral transmission [25]. Regional block anesthesia has beneficial effects of preservation of respiratory function, to avoid SARS-CoV-2 viral aerosolization and transmission [25]. Therefore, the provision of regional block anesthesia may be the key during this COVID-19 pandemic, as it may reduce the need for general anesthesia.

Another factor to consider for endourological procedures is exposure to urine during the surgery. Most studies of NATs using urine specimens for SARS-CoV-2 have been negative [26,27]. One study in China reported that the urine of four of 58 hospitalized COVID-19 patients was detected to be SARS-CoV-2 RNA positive [28]. Out of caution, minimization of trauma and waterproofing of surgical equipment are recommended during endourological surgery to decrease the risk of urine contact transmission during the COVID-19 pandemic.

In addition, telemedicine proved a pragmatic and convenient approach to decrease the frequency of face-to-face visit and maintain appropriate patient care during the COVID-19 pandemic [12,29]. Most outpatient urology visits are not urgent. Therefore, taking full advantage of telemedicine to reduce unnecessary physical exposure is of great importance.

It should be noted that this study has some limitations. First, all the NATs were based on upper respiratory tract specimens using nasopharyngeal or oropharyngeal swab;
the positive rate may be higher in detection using lower respiratory tract specimens, such as bronchoalveolar lavage fluid, which may yield higher sensitivity for NATs. Second, this study was limited to two centers only; it is necessary to investigate the risk of urological patients scheduled for surgery in a multicenter study with a larger sample size. Third, the longitudinal follow-up and chest CT, NATs, and antibodies should be traced for very-high- and high-risk patients.

5. Conclusions

Of the 319 patients, seven were identified with very high and high risk, which reinforced the importance of epidemic surveillance of discharged COVID-19 patients and asymptomatic infections. Our experience of risk assessment and management practice may provide a strategy to prevent SARS-CoV-2 transmission for hospitalized urological patients after the COVID-19 pandemic.

Table 6 – Clinical characteristics and SARS-CoV-2 parameters of seven patients with very high and high risk for transmission.

| No. | Age (yr) | Gender | Urological disease | History of COVID-19 | Chest CT findings | First time | 1 wk later | Treatment |
|-----|----------|--------|--------------------|---------------------|-------------------|-----------|-----------|-----------|
|     |          |        |                    |                     |                   | Nucleic acid | IgG IgM | Nucleic acid | IgG IgM |          |
| 1   | 89       | Male   | Prostatic hyperplasia | No                  | Ground-glass opacities and fibrotic streaks in the lower right lung | – | + | – | – | + | Drug treatment |
| 2   | 44       | Female | Kidney stone        | No                  | Ground glass density patches in the right middle lung and left lingual lobe | – | – | + | – | + | Drug treatment |
| 3   | 63       | Male   | Prostate cancer     | No                  | Ground-glass opacities and strip shadow in the upper left lung, the lobe of tongue, and the middle right lung | – | + | – | – | + | Active monitoring |
| 4   | 47       | Male   | Hydronephrosis with ureteral stricture | Yes | Multiple ground-glass density patches in the lower lobes of both lungs | – | – | – | – | – | Nephrostomy under local anesthesia |
| 5   | 53       | Male   | Ureteral stone      | No                  | Ground-glass opacities in the lower lobe of the left lung and blurred patchy shadows in the left upper lobe of the lung | – | + | – | – | + | Double J stent placement |
| 6   | 57       | Male   | Elevated PSA        | No                  | Multiple ground-glass opacities of double lower lung | – | + | + | – | + | Active monitoring |
| 7   | 67       | Male   | Prostatic hyperplasia | No | Ground-glass opacities and fibrotic streaks in the lingual segment of the upper lobe of the left lung and the middle lobe of the right lung | – | + | – | – | + | Drug treatment |

COVID-19 = coronavirus disease 2019; CT = computed tomography; IgG = immunoglobulin G; IgM = immunoglobulin M; PSA = prostate specific antigen; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

Table 7 – Clinical characteristics and SARS-CoV-2 parameters of five patients with medium risk for transmission.

| No. | Age (yr) | Gender | Urological disease | History of COVID-19 | Chest CT findings | First time | 1 wk later | Anesthesia | Surgery |
|-----|----------|--------|--------------------|---------------------|-------------------|-----------|-----------|-----------|---------|
|     |          |        |                    |                     |                   | Nucleic acid | IgG IgM | Nucleic acid | IgG IgM |           |          |
| 1   | 59       | Female | Kidney stone       | No                  | Scattered fibrotic streaks in the right upper lung | – | + | – | + | – | Paravertebral block anesthesia |
| 2   | 66       | Male   | Prostatic hyperplasia | No | Scattered fibrotic streaks in the left lower lung | – | + | – | – | + | Epidural block anesthesia |
| 3   | 63       | Male   | Prostate cancer    | No                  | Fibrotic streaks in the lower lobes of both lungs | – | + | – | + | – | Combined lumbar anesthesia and epidural block |
| 4   | 52       | Male   | Ureteral stone     | No                  | Scattered fibrotic streaks in the upper right lung and the middle lobe of the left lung | – | + | – | – | + | Epidural block anesthesia |
| 5   | 53       | Female | Bladder cancer     | No                  | Fibrotic streaks in the lower lobe of the left lung | – | + | – | + | – | Epidural block anesthesia |

COVID-19 = coronavirus disease 2019; CT = computed tomography; IgG = immunoglobulin G; IgM = immunoglobulin M; LA = laparoscopic adrenalectomy; PCNL = percutaneous nephrolithotomy; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; TURBt = transurethral electroresection of bladder tumor; TURP = transurethral resection of the prostate; URS = ureterolithotomy.
Author contributions: Zhiqiang Chen and Kun Tang had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Chen, Tang, Peng, Xia, Gao.

Acquisition of data: Peng, Xia, Gao.

Analysis and interpretation of data: Chen, Tang, Peng, Xia, Gao.

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Statistical analysis: Zhan, H, Yang, X. Yang, Xu, Qu, Sun.

Obtaining funding: Tang.

Administrative, technical, or material support: Chen, Tang.

Supervision: Chen, Tang, Peng, Xia, Gao.

Other: None.

Financial disclosures: Kun Tang certifies that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (eg, employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patents filed, received, or pending), are the following: None.

Funding/Support and role of the sponsor: This work was funded by the National Natural Science Foundation of China (No. 81900645).

Acknowledgments: We thank the patients who participated in this study.

CRediT authorship contribution statement

Ejun Peng: Conceptualization, Data curation, Supervision.

Ding Xia: Conceptualization, Data curation, Supervision.

Wenxi Gao: Conceptualization, Data curation, Supervision.

Ying Zhan: Methodology. Huan Yang: Methodology. Xiaoqi Yang: Methodology. Hua Xu: Methodology. Xiaoling Qu: Methodology. Jie Sun: Methodology. Shaogang Wang: Writing - review & editing. Zhiqun Ye: Writing - review & editing. Kun Tang: Conceptualization, Data curation, Writing - original draft, Funding acquisition, Supervision.

Zhiqiang Chen: Conceptualization, Data curation, Writing - original draft, Supervision.

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