



## Statistics in Urology

# Applicability of COVID-19 Pandemic Recommendations for Urology Practice: Data from Three Major Italian Hot Spots (BreBeMi)

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### Abstract

**Background:** Lombardy has been the first and one of the most affected European regions during the first and second waves of the novel coronavirus (severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2]).

**Objective:** To evaluate the impact of coronavirus disease 2019 (COVID-19) on all urologic activities over a 17-wk period in the three largest public hospitals in Lombardy located in the worst hit area in Italy, and to assess the applicability of the authorities' recommendations provided for reorganising urology practice.

**Design, setting, and participants:** A retrospective analysis of all urologic activities performed at three major public hospitals in Lombardy (Brescia, Bergamo, and Milan), from January 1 to April 28, 2020, was performed.

**Outcome measurements and statistical analysis:** Join-point regression was used to identify significant changes in trends for all urologic activities. Average weekly percentage changes (AWPCs) were estimated to summarise linear trends. Uro-oncologic surgeries performed during the pandemic were tabulated and stratified according to the first preliminary recommendations by Stensland et al (Stensland KD, Morgan TM, Moinzadeh A, et al. Considerations in the triage of urologic surgeries during the COVID-19 pandemic. *Eur Urol* 2020;77:663–6) and according to the level of priority recommended by European Association of Urology guidelines.

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**Results and limitations:** The trend for 2020 urologic activities decreased constantly from weeks 8–9 up to weeks 11–13 (AWPC range –41%, –29.9%;  $p < 0.001$ ). One-third of uro-oncologic surgeries performed were treatments that could have been postponed, according to the preliminary urologic recommendations. High applicability to recommendations was observed for non-muscle-invasive bladder cancer (NMIBC) patients with intermediate/emergency level of priority, penile and testicular cancer patients, and upper tract urothelial cell carcinoma (UTUC) and renal cell carcinoma (RCC) patients with intermediate level of priority. Low applicability was observed for NMIBC patients with low/high level of priority, UTUC patients with high level of priority, prostate cancer patients with intermediate/high level of priority, and RCC patients with low level of priority.

**Conclusions:** During COVID-19, we found a reduction in all urologic activities. High-priority surgeries and timing of treatment recommended by the authorities require adaptation according to hospital resources and local incidence.

**Patient summary:** We assessed the urologic surgeries that were privileged during the first wave of coronavirus disease 2019 (COVID-19) in the three largest public hospitals in Lombardy, worst hit by the pandemic, to evaluate whether high-priority surgeries and timing of treatment recommended by the authorities are applicable. Pandemic recommendations provided by experts should be tailored according to hospital capacity and different levels of the pandemic.

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## 1. Introduction

At the end of the 21st century, we have been facing a second wave of an international public health emergency, a respiratory disease (coronavirus disease 2019 [COVID-19]) caused by a novel coronavirus (severe acute respiratory syndrome coronavirus 2[SARS-CoV-2]) [1,2]. As of November 14, 2020, a total of 53 164 803 confirmed cases and 1 300 576 confirmed deaths in 220 countries were recorded, according to the World Health Organization (WHO) data [3]. Since its outbreak in December 2019 in China [4], COVID-19 has spread rapidly all around the world, seeing Italy as the first European country to be hit by the virus and one of the most affected countries [5,6]. The first case of COVID-19 in Italy was reported on February 21, 2020, in the Lombardy region, which since then has always been on top of the ranking also during the second wave, with 1 144 552 confirmed cases and 44 683 deaths as of November 14, 2020 [7,8]. Milan, Brescia, and Bergamo have reported the highest number of cases since the beginning of this outbreak [7,8]. Some authors reported their experience and the dramatic changes caused by COVID-19 in the management of urologic activities [9–14]. However, the majority of these reports are qualitative studies that did not quantify the impact of this emergency on urologic activities [9,14] or exclusively focused on the reduction of *one* urologic activity (ie, surgery or urologic emergencies) during the *early* phase of COVID-19 emergency [10–13], combining data of several European centres with different local capacities and different local incidences [11]. Therefore, a clear overview of the repercussions of SARS-CoV-2 on urologic practice is lacking. Moreover, it became challeng-

ing to identify which uro-oncologic patients required nondeferrable management in order to avoid delaying life-saving treatments [9]. During the first wave, several authorities [15–17], including urologic guidelines [18], redefined treatment options and timing of urologic surgical activities with the purpose of reorganising urologic practice during the COVID-19 pandemic. The first recommendations were published by Stensland et al [15] on March 15, 2020, with the input of multiple departments in Europe and the USA. After almost 2 mo (April 17, 2020) since the COVID-19 outbreak, the European Association of Urology (EAU) guideline recommendations were adapted to support urologists during this unprecedented health care crisis [18]. These recommendations were based exclusively on expert opinions, bringing into question whether they are applicable in public hospitals that became almost entirely dedicated to COVID-19 treatment and require validation as we are facing the second flow of this pandemic. To fill these gaps, we quantified the impact of COVID-19 on urologic surgical volumes (oncologic, nononcologic, and emergency surgeries), consultations, admissions for urologic diseases, urologic consultations requested by the central emergency department (ED), prostate biopsies, and cystoscopies in the three largest public hospitals in Lombardy located in the hardest hit area in Italy, namely, in the provinces of Brescia, Bergamo, and Milan (BreBeMi), over a 17-wk period (from January 1 to April 28, 2020). Moreover, the urologic surgeries privileged since the COVID-19 outbreak in Italy were assessed to evaluate whether high-priority surgeries and timing of treatment recommended by the authorities [15,18] are applicable.

## 2. Patients and methods

### 2.1. Data source

The current study relied on a retrospectively maintained database that collected data on all urologic activities performed at Spedali Civili (Brescia), Papa Giovanni XXIII (Bergamo), and Grande Ospedale Metropolitano Niguarda (Milan) from January 1 to April 28, 2020. The Department of Urology of Spedali Civili (Brescia) has 64 beds, it is normally staffed by 14 full-time urologists, and 4000 urologic surgeries are performed annually. The Department of Urology of Papa Giovanni XXIII (Bergamo) has 40 beds, it is normally staffed by 13 full-time urologists, and 2500 urologic surgeries are performed annually. The Department of Urology of Grande Ospedale Metropolitano Niguarda (Milan) has 20 beds, it is normally staffed by 11 full-time urologists, and 1900 urologic surgeries are performed annually.

### 2.2. Statistical analysis

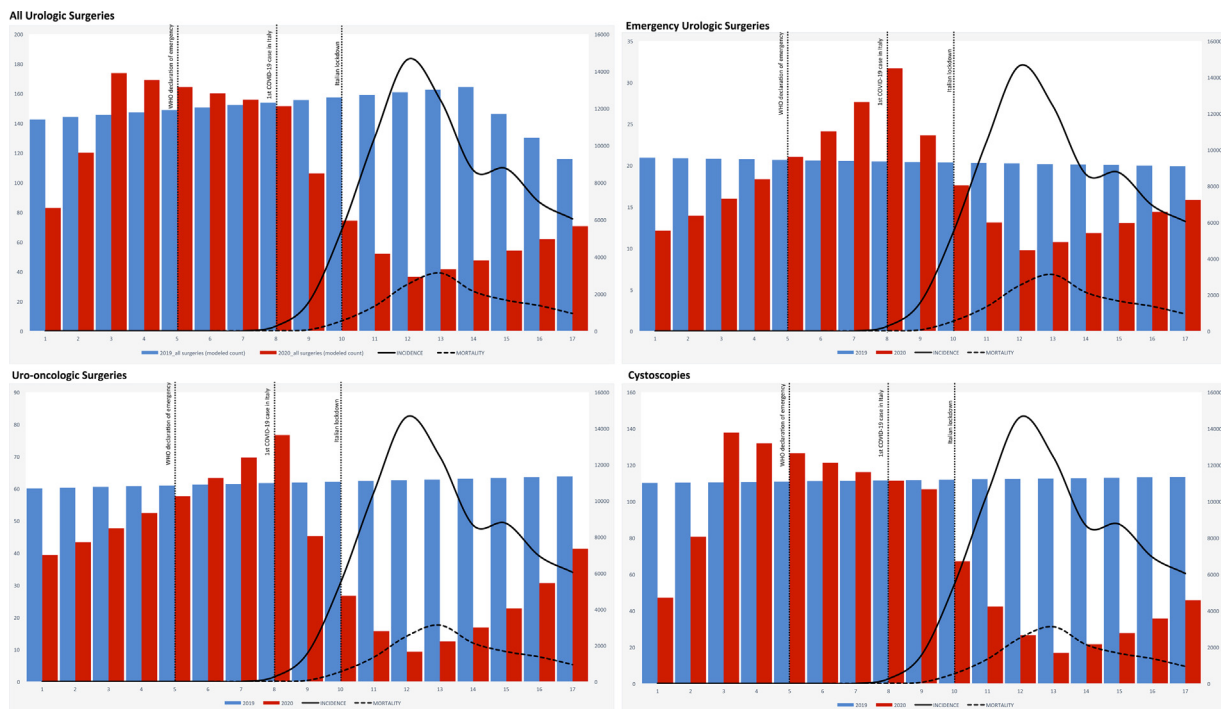
Statistical analysis consisted of five steps. First, a retrospective chart review of all urologic activities (ie, all urologic surgeries, emergency and oncologic surgeries, cystoscopies, prostate biopsies, consultations, admissions for urologic diseases, and urologic consultations requested by the central ED) of the three urologic departments from January 1 to April 28, 2020 was performed. The urologic activity was assessed weekly and compared with 2019 urologic activity during the same time frame to provide a control group. Data referring to the same weeks of 2019 and 2020 were matched. Second, a join-point regression model was used to identify statistically significant changes in trends for each urologic activity over time [19,20]. Average weekly percentage change (AWPC) and 95% confidence intervals (95% CIs) were estimated to summarise linear trends during the time frame assessed. Third, weekly urologic

activities were temporally correlated with the weekly incidence and mortality of COVID-19 in Lombardy relying on the Pearson correlation method. COVID-19 epidemiology data on incidence and mortality were obtained from the Italian Ministry of Health [8]. Fourth, we assessed the “lag time” between the first COVID-19 case in Lombardy (February 21), the WHO public declaration of emergency (January 30), the Italian declaration of lockdown (March 9), and the reduction/blockage of the urologic activities by the government of Lombardy. Fifth, we assessed which urologic surgeries were privileged from February 21 to April 28, 2020, to evaluate whether high-priority surgeries and timing of treatment recommended by the authorities [15,18] are applicable during this health care crisis. Uro-oncologic surgeries performed in the three urologic departments were tabulated and stratified according to the first preliminary recommendations by Stensland et al [15] on March 15, 2020, and according to the level of priority recommended by the COVID-19 EAU guidelines on April 17, 2020 [18]. Analyses were performed using the R software version 3.5.1 (R Foundation for Statistical Computing, Vienna, Austria) and JoinPoint Trend Analysis Software version 4.2.0.2 (Statistical Research and Applications Branch, National Cancer Institute, St. Louis, MO, USA).

## 3. Results

### 3.1. Trend pattern analysis

During 2019, the weekly amount of urologic surgeries (AWPC  $-0.3$ ; 95% CI  $-1.5, 1$ ;  $p=0.6$ ; Fig. 1A), emergency urologic surgeries (AWPC  $-0.3$ ; 95% CI  $-2.2, 1.6$ ;  $p=0.7$ ; Fig. 1B), uro-oncologic surgeries (AWPC  $+0.4$ ; 95% CI  $-1.1, 1.9$ ;  $p=0.6$ ; Fig. 1C), cystoscopies (AWPC  $+0.2$ ; 95% CI  $-1.4, 1.8$ ;  $p=0.8$ ; Fig. 1D), prostate biopsies (AWPC  $-0.8$ ; 95% CI  $-3.4, 1.8$ ;  $p=0.5$ ; Fig. 1E), urologic consultations (AWPC  $-0.8$ ; 95% CI



**Fig. 1 – Weekly urologic activity performed between January 1 and April 28 in 2019 and 2020, in the three largest public hospitals in Lombardy located in the worst hit area in Italy (Brescia, Bergamo, and Milan): (A) all urologic surgeries, (B) emergency urologic surgeries, (C) uro-oncologic surgeries, (D) cystoscopies, (E) prostate biopsies, (F) urologic consultations, (G) admissions for urologic diseases, and (H) urologic consultations requested by the central emergency department. COVID-19 = coronavirus disease 2019; WHO = World Health Organization.**

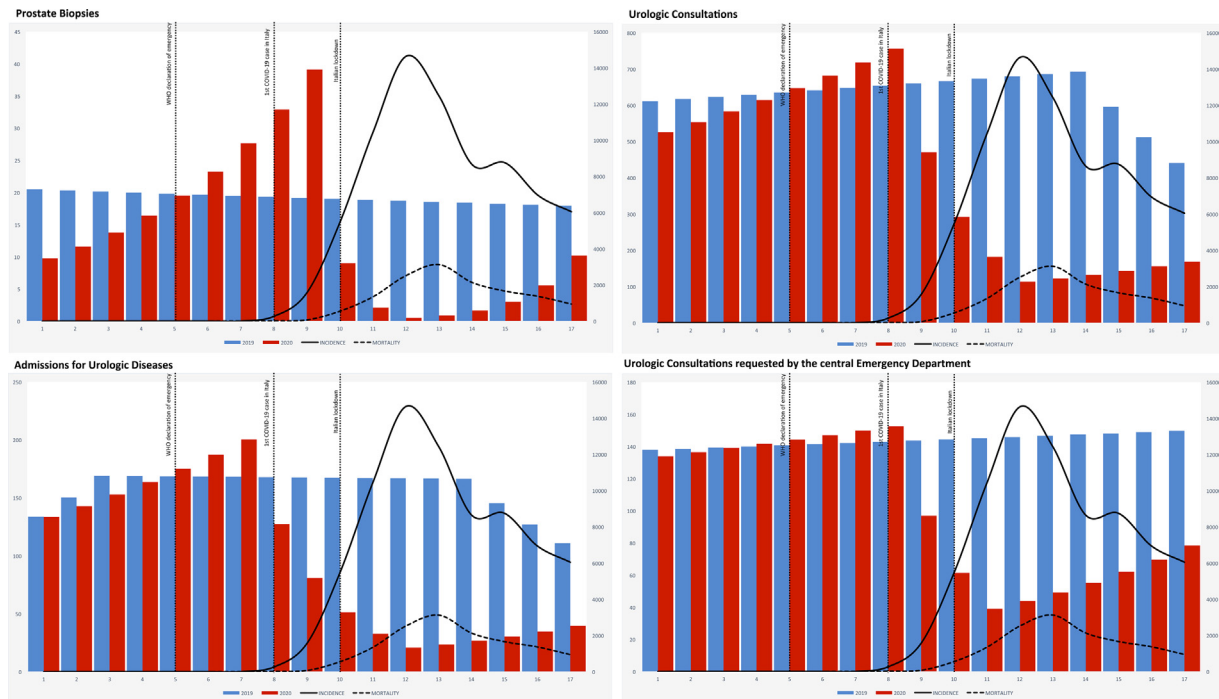


Fig. 1. (Continued).

–2.2, 0.7;  $p=0.3$ ; Fig. 1F), admissions for urologic diseases (AWPC –0.9; 95% CI –2.3, 0.5;  $p=0.2$ ; Fig. 1G), and urologic consultations requested by the central ED (AWPC +0.5; 95% CI –0.2, 1.2;  $p=0.1$ ; Fig. 1H) performed was fairly stable over time. Conversely, the trend for 2020 urologic surgeries decreased constantly from week 8 up to week 12 (AWPC –29.9; 95% CI –40, –18.3;  $p < 0.001$ ), followed by a significant increase (AWPC +14.1; 95% CI 6.5, 22.2;  $p < 0.001$ ; Fig. 1A). A not statistically significant decrease was observed for 2020 emergency urologic surgeries from week 8 up to week 12 (AWPC –25.5; 95% CI –46.9, 4.5;  $p=0.1$ ; Fig. 1B). Thereafter, a nonstatistically significant increment of 2020 emergency urologic surgeries was observed (AWPC +10.2; 95% CI –5.3, 28.2;  $p=0.2$ ; Fig. 1B). On the contrary, the trend for 2020 uro-oncologic surgeries showed a sharp significant decrease with an AWPC of –41 (95% CI –60, –13;  $p < 0.001$ ) from week 8 up to week 12, followed by a statistically significant rise (AWPC +34.9; 95% CI 13.3, 60.5;  $p < 0.001$ ; Fig. 1C). A significant constantly decreasing trend was observed also for 2020 cystoscopies (AWPC –37; 95% CI –46.7, –25.5;  $p < 0.001$ ) from week 9 up to week 13, followed by a statistically significant increase (AWPC +28.6; 95% CI 15.6, 42.9;  $p < 0.001$ ; Fig. 1D). A joint-point regression analysis of 2020 weekly prostate biopsies showed a nonstatistically significant reduction from week 9 up to week 12, with an AWPC of –77 (95% CI –97.3, 94.8;  $p=0.2$ ; Fig. 1E), and then an increase up to week 17 (AWPC +84.4; 95% CI 14.4, 197.2;  $p < 0.001$ ; Fig. 1E). Similarly, the trend for 2020 urologic consultations showed a significant constantly decreasing trend from week 8 up to week 12 (AWPC –37.8; 95% CI –53.7, –16.4;  $p < 0.001$ ), followed by a not statistically significant

increment (AWPC +8.3; 95% CI –5.2, 23.6;  $p=0.2$ ; Fig. 1F). A significant drop was found for 2020 admissions for urologic diseases from week 7 up to week 12 (AWPC –46.4, –24.8;  $p < 0.001$ ; Fig. 1G), then rose up to week 17 (AWPC +13.8; 95% CI 1, 28.4;  $p < 0.001$ ; Fig. 1G). The joint-point regression analysis of 2020 weekly urologic consultations requested by the central ED showed a constant significant decrease from week 8 up to week 11 (AWPC –36.5; 95% CI –49.1, –20.9;  $p < 0.001$ ; Fig. 1H). A change in trend over time was observed thereafter (AWPC +12.3; 95% CI 8.2, 16.6;  $p < 0.001$ ; Fig. 1H).

Supplementary Table 1 shows the correlation between weekly urologic activities and weekly incidence and mortality of COVID-19 in Lombardy. The weekly decrease trends of all urologic activities in 2020 from week 8/9 correlated strongly with the upswing in weekly trends of incidence and mortality of COVID-19 in Lombardy (correlation coefficient ranged between –0.98 and –0.83; all  $p \leq 0.03$ ; Supplementary Table 1).

A lag time analysis revealed a sharp decrease of urologic surgeries (Fig. 1A–C), urologic consultations (Fig. 1F), admissions for urologic diseases (Fig. 1G), and urologic consultations requested by the central ED (Fig. 1H) since the first COVID-19 case in Italy from week 8. Conversely, a delay of 1 wk was observed for a reduction of diagnostic procedures (ie, cystoscopies and prostate biopsies; Fig. 1D and 1E). Moreover, a lag time analysis revealed that the initial reduction of urologic activities was observed >3 wk after WHO public declaration of emergency (Fig. 1) and that the Italian lockdown was declared on March 9, when all urologic activities were reduced by >50% (Fig. 1).

### 3.2. Applicability of authorities' recommendations

From February 21 to April 28, 2020, 15 patients refused urologic surgery in the three hospitals. All these patients were candidates to transurethral resection for bladder tumour (TURBT). Overall, 232 uro-oncologic surgeries were performed during the time frame assessed (Table 1). Of these, 161 (69.4%) and 71 (30.6%) were, respectively, surgeries that should be prioritised and delayed during COVID-19 according to the recommendations of Stensland et al [15]. A total of 104 (44.8%) and 24 (10.3%) patients underwent TURBT for suspected cT1+ tumour and radical cystectomy with extended pelvic lymph node dissection (ePLND), respectively. Of the patients, 10% ( $n=23$ ) underwent partial (PN) or radical (RN) nephrectomy for cT1a or T1b tumour. Overall, 4.7% ( $n=11$ ), 4.7% ( $n=11$ ), and 5.2% ( $n=12$ ) underwent orchiectomy, TURBT for nonsuspected cT1+ tumour, and radical prostatectomy (RP) with ePLND for locally advanced prostate cancer (PCa; Table 1). Less than 4% of the uro-oncologic surgeries performed during the COVID-19 emergency were represented by RN for patients with  $\geq$ cT3 renal tumour ( $n=5$ ; 2.2%), PN or RN for patients harbouring cT2a/T2b renal tumour ( $n=8$ ; 3.4%), RP with ePLND for intermediate-risk ( $n=8$ ; 3.4%) and high-risk ( $n=9$ ; 3.9%) PCa patients, kidney-sparing surgery/radical nephroureterectomy for patients with low- ( $n=4$ ; 1.7%) and high-risk ( $n=9$ ; 3.9%) upper tract urothelial cell carcinoma (UTUC), adrenalectomy for patients harbouring adrenal tumour  $>6$  cm ( $n=3$ , 1.3%), and total penectomy for patients with penile cancer ( $n=1$ ; 0.4%).

Table 2 shows the type of uro-oncologic surgeries performed during the time frame assessed, stratified

according to the level of priority (low, intermediate, and high priority, and emergency) recommended by COVID-19 EAU guidelines [18]. For non-muscle-invasive bladder cancer (NMIBC), 0%, 90%, 42%, and 100% applicability of COVID-19 EAU guideline recommendations was observed for, respectively, low-, intermediate-, high-priority, and emergency surgeries. Regarding UTUC, 100% and 11% applicability was acknowledged for, respectively, intermediate- and high-priority surgeries. For muscle-invasive bladder cancer (MIBC), applicability of 88% to intermediate- and 70% to high-priority surgeries according to COVID-19 EAU guideline recommendations were shown. For renal cell carcinoma (RCC) patients, we showed applicability of 8%, 100%, and 82% for, respectively, low-, intermediate-, and high-priority surgeries. Regarding PCa patients, applicability of 0% and 33% was observed for, respectively, intermediate- and high-risk-priority surgeries. Finally, for penile and testicular cancer patients, applicability of 100% to COVID-19 EAU guideline recommendations was acknowledged (Table 2).

### 4. Discussion

Our analyses demonstrated several noteworthy findings. First, an overwhelming decrease was observed for all 2020 urologic activities assessed since the COVID-19 outbreak in Italy from week 8/9 up to weeks 11–13. Thereafter, all urologic activities showed a constant increase up to the end of the time frame assessed. These trends mirrored the COVID-19 epidemiology trends in Lombardy in terms of incidence and mortality. Especially, a negative correlation was observed between all urologic activities and

**Table 1 – Uro-oncologic surgeries (232 in total) performed in the three largest public hospitals in Lombardy located in the most affected area in Italy (Brescia, Bergamo, and Milan) from February 21 to April 28, 2020, according to Stensland et al's [15] recommendations**

Stensland recommendations	Disease	Type of surgery	Patients treated, n (%)	Patients treated, n (%)	
Surgeries that should be prioritised	Bladder cancer	RC	24 (10.3)	161 (69.4)	
	Testicular cancer	TURBT for suspected cT1+ tumour	104 (44.8)		
		Orchiectomy	11 (4.7)		
	Kidney cancer for cT3+ tumours, including patients with renal vein and/or IVC thrombi	RN	5 (2.2)		
		High-risk UTUC	RNU/kidney-sparing surgery	9 (3.9; 8 RNU and 1 kidney-sparing surgery)	
	Low-risk UTUC	Kidney-sparing surgery	4 (1.7)		
	Adrenal tumour (>6 cm)	Adrenalectomy	3 (1.3)		
	Penile cancer	Total penectomy	1 (0.4)		
	Surgeries that should be delayed <sup>a</sup>	Bladder cancer	TURBT not suspected for cT1+ tumour	11 (4.7)	71 (30.6)
		Kidney cancer for cT2a/T2b tumours	PN or RN	8 (3.4)	
Kidney cancer for cT1a/T1b tumours		PN or RN	23 (9.9)		
Intermediate-risk PCa		RP + ePLND	8 (3.4)		
High-risk PCa		RP + ePLND	9 (3.9)		
High-risk (locally advanced) PCa		RP + ePLND	12 (5.2)		

ePLND = extended pelvic lymph node dissection; IVC = inferior vena cava; PCa = prostate cancer; PN = partial nephrectomy; RC = radical cystectomy; RN = radical nephrectomy; RNU = radical nephroureterectomy; RP = radical prostatectomy; TURBT = transurethral resection of bladder tumour; UTUC = upper tract urothelial cell carcinoma.

<sup>a</sup> cT1 renal masses should be delayed or other forms of ablative approaches should be considered; cT2 renal masses should be considered for delay based upon patient-specific considerations, such as age, morbidity, symptoms, and tumour growth rate. Most prostatectomies should be delayed. If high-risk PCa patients are ineligible for radiation therapy, radical prostatectomy should be considered.

**Table 2 – Uro-oncologic surgeries performed in the three largest public hospitals in Lombardy located in the most affected area in Italy (Brescia, Bergamo, and Milan) from February 21 to April 28, 2020, stratified according to the level of priority and timing of surgery defined by EAU guidelines during the COVID-19 pandemic [18]**

Disease	Type of surgery performed	Levels of priority according to EAU guidelines during COVID-19 pandemic, % (n/N)	Timing of surgery according to EAU guidelines during COVID-19 pandemic	Applicability of guideline recommendations, % (n/N) <sup>a</sup>
105 NMIBC	105 TURBT	10 (11/105) low priority	Treatment deferred by 6 mo	0 (0/11)
		40 (42/105) intermediate priority	Treat within 3 mo	90 (38/42)
		48 (50/105) high priority	Treat within 6 wk	42 (21/50)
		2 (2/105) emergency	Treat within 24 h	100 (2/2)
13 UTUC	8 RNU: 4 Robot-assisted RNU 2 Open RNU	31 (4/13) intermediate priority	Treat within 3 mo	100 (4/4)
		69 (9/13) high priority	Treat within 6 wk	11 (1/9)
		2 Laparoscopic RNU		
		5 Kidney-sparing surgery <sup>b</sup> (2 distal ureterectomy and 3 RIRS)		
34 MIBC	24 RC: 5 Robot-assisted RC 19 Open RC	71 (24/34) intermediate priority	Treat within 3 mo	88 (21/24)
		29 (10/34) high priority	Treat within 6 wk	70 (7/10)
		10 TURBT (for suspicious of invasive tumour at imaging)		
36 RCC	20 PN: 14 Robot-assisted PN 4 Open PN 2 Laparoscopic PN	36 (13/36) low priority	Treatment deferred by 6 mo	8 (1/13)
		33 (12/36) intermediate priority	Treat within 3 mo	100 (12/12)
		31 (11/36) high priority	Treat within 6 wk	82 (9/11)
		16 RN: 6 Robot-assisted RN 2 Open RN		
		8 Laparoscopic RN		
2 Adrenocortical carcinoma + 1 metastatic RCC	3 Adrenalectomy 1 Robot assisted 1 Open 1 Laparoscopic	No priority provided by guidelines	No timing provided by guidelines	–
		59 (17/29) intermediate priority	RP to postpone until after pandemic; if patients anxious consider ADT+RT	0 (0/17)
		41 (12/29) high priority	Treat within 6 wk	33 (4/12)
11 Penile cancer	1 Total penectomy	100 (1/1) high priority	Treat within 6 wk	100 (1/1)
11 Testicular cancer	11 Orchiectomy	100 (11/11) emergency	Diagnose and treat within 24h	100 (11/11)

ADT = androgen deprivation therapy; COVID-19 = coronavirus disease 2019; EAU = European Association of Urology; MIBC = muscle-invasive bladder cancer; NMIBC = non-muscle-invasive bladder cancer; PCa = prostate cancer; PN = partial nephrectomy; RC = radical cystectomy; RCC = renal cell carcinoma; RIRS = retrograde intrarenal surgery; RN = radical nephrectomy; RNU = radical nephroureterectomy; RP = radical prostatectomy; RT = radiotherapy; TURBT = transurethral resection of bladder tumour; UTUC = upper tract urothelial cell carcinoma.

<sup>a</sup> Patients treated within the timing recommended by EAU guidelines.

<sup>b</sup> One high-risk nonmetastatic patient with impaired renal function received kidney-sparing surgery.

weekly trends of incidence and mortality of COVID-19 during the upswing in the pandemic phase. Overall, these findings display strongly the alteration of daily urologic clinical practice during COVID-19 outbreak. Indeed, all three high-volume urologic departments became almost entirely dedicated to the treatment of COVID-19 patients. Specifically, anaesthesiologists, nurses, and urologists were employed daily for managing acute COVID-19 patients. Moreover, the number of medical and paramedical staff infected with SARS-CoV-2 was rising. As of April 21, 2020, a total of 22 000 health care workers have been infected in

Italy, representing 10% of overall positive cases in Italy [21]. Therefore, there was a lack of health care personnel managing the elective urologic surgeries. In addition, beds generally available for urologic procedures were needed for the newly hospitalised COVID-19 patients, of whom approximately 20% required intensive care unit admission [22], further contributing to the decline in elective surgeries and patient admissions for urologic diseases observed during the upswing in the pandemic phase. Urologic consultations and diagnostic procedures (ie, cystoscopies and prostate biopsies) were reduced as well during the

upswing in the pandemic phase to lower the risk of infecting elective patients. Priority was given to emergency consultations and patients with high-risk malignancies within the 1st year of follow-up. A significant reduction in urologic consultations requested by the central ED was also observed from weeks 8 to 11. This could partially be explained by the already reported abuse of ED service by Italian patients to reduce the length of time for diagnosis/treatment of urologic diseases [12]. A further possible explanation could be the reluctance to turn to ED service for the fear of being infected, despite the urgency for urologic consultation [23]. A decrease during the upswing in the pandemic phase was also observed for emergency surgeries. However, as expected, this was nonstatistically significant, suggesting that emergency surgeries cannot be postponed because of their gravity even during pandemic time. Overall, this general decrease of the urologic activities translates into missed/delayed diagnoses of urologic diseases, deferral treatment of many urologic malignancies, and less intensive oncologic follow-up of genitourinary cancer patients [24]. The consequences of this unprecedented health care scenario are premature to estimate, and future data will be produced in coming years that analyse the impact of diagnosis and treatment delays, and deintensification of follow-up on urologic outcomes. It might end in a higher number of patients being diagnosed with advanced urologic diseases and an increased cancer-specific mortality rate, especially for more aggressive cancers [24]. At the same time, it might be possible that a significant treatment delay of selected early-stage cancers or less intensive follow-up protocols will not impact long-term outcomes adversely, providing evidence to update current urologic guidelines. To partially limit the consequences of this massive breakdown, since the middle/end of March (weeks 12–13; Fig. 1) when the incidence and mortality for COVID-19 in Lombardy reached the peak, a changing tendency was observed: a slow, constant reopening of all urologic activities was observed in all three centres involved in the “red area”. Unfortunately, nowadays we are facing the second wave of this pandemic, reshaping again the health systems in several countries worldwide. It seems remote that medical practice will return to pre-COVID-19 patterns in the near future. Therefore, it becomes imperative to adapt and modify our urologic practice. In this regard, in order to reduce in-person interactions and the consequent risk of contagion, an increasing interest has been observed for the application of telemedicine to provide urologic care [25,26]. Evidence suggested that telemedicine has been implanted successfully in several urologic conditions [26], making it appealing also after the end of this emergency.

Second, we observed a prompt reply in the reduction of urologic activities by Lombardy region relative to the first COVID-19 case in Italy, except for diagnostic procedures (ie, cystoscopies and prostate biopsies), which started to show a drop-off 1 wk later. Notably, the WHO public declaration of emergency did not influence the reduction of all urologic activities, and the Italian declaration of lockdown arrived when the urologic practice had already been reduced overwhelmingly (Fig. 1). Overall, these findings suggest a

time gap between the onset of the emergency and the central government decisions. Nevertheless, it has to be acknowledged that the Italian government has been the first among the western countries to face the decision of a national lockdown.

Third, when we assessed the uro-oncologic surgeries performed from February 21, 2020 to April 28, 2020, we observed that 70% were high-priority surgeries according to the recommendations by Stensland et al [15]. Notably, 30% of these surgeries were treatments that could have been postponed according to the expert recommendations (Table 1) [15]. When we retrospectively assessed whether the treatment options and, especially, the timing of urologic surgical activities redefined by EAU guidelines during the COVID-19 pandemic [18] are applicable, we observed high applicability (ie, 90–100%) for NMIBC patients with intermediate and emergency levels of priority, penile and testicular cancer patients, and UTUC and RCC patients with intermediate level of priority (Table 2). Intermediate applicability (ie, 70–89%) was observed for MIBC with intermediate and high levels of priority and for RCC with high level of priority. Conversely, low applicability (ie, 0–69%) was identified for NMIBC patients with low and high levels of priority, UTUC patients with high level of priority, PCa patients with intermediate and high levels of priority, and RCC patients with low level of priority. The considerable rate of nonpriority surgeries that were performed (Table 1) and the low applicability of guideline recommendations, especially for malignancies defined as high priority (Table 2), were expected, considering the single department case mix and bearing in mind that typically urologic departments fight to treat uro-oncologic patients within the deadline (ie, 30 d) proposed by regional guidelines outside the COVID-19 era [9]. The findings observed might be explained by the fact that urologists had to struggle with a new scenario: reorganise the operating rooms (ORs) according to urologically prioritised malignancies [24], reduced number of accessible ORs, available health care staff, and number of elective vacant urologic and intensive care unit beds [22], and move to COVID-free structures to treat urologic patients and patients who refused to receive any kind of treatment during the COVID-19 period. Overall, these results suggest that urologic pandemic recommendations provided by experts [15,18] should be tailored according to hospital capacity and different levels of the pandemic. This is the key and could provide a model for on-going care in case of future pandemics with novel pathogens.

Our study is not devoid of limitations. First, our findings derive from the three Italian public urologic departments most affected by this pandemic. Second, when we assessed the applicability of COVID-19 pandemic recommendations, we did not account for those patients who refused surgery ( $n = 15$ ). However, it is of note that none of these patients was a candidate for major or minor surgeries (ie, TURBT) with high/emergency priority level. Conversely, all these patients were candidates for TURBT with low/intermediate priority level. Therefore, it is unlikely that the applicability of COVID-19 guideline recommendations provided by our

study would have been affected significantly. Third, all these three departments are high-volume centres where generally more advanced malignancies are treated. Therefore, the epidemic could have had a different impact in other divisions outside the hotspot of Brescia, Bergamo, and Milan, with lower caseload. However, this report represents the first study that quantified the influence of COVID-19 on all 2020 urologic activities over a 17-wk period, and the first study to correlate the trend of all urologic activities with COVID-19 epidemiology data throughout the COVID-19 pandemic period and with the public declarations of emergency/lockdown. Last, this represents the first study that evaluates whether high-priority surgeries and timing of treatment, recommended by several authorities, are applicable in the urologic departments worst hit by this pandemic.

## 5. Conclusions

All urologic activities in the three largest public hospitals in Lombardy, worst hit by the pandemic, underwent a considerable reduction throughout the COVID-19 pandemic period. High-priority surgeries and timing of treatment recommended by the authorities require adaptation according to hospital resources and local incidence. Overall, our results call for Italian government endorsement of recommendations by the authorities, in order to guarantee proper treatment during a pandemic. This is crucial as we are facing a second wave of the disease.

**Author contributions:** Paolo Dell'Oglio had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

*Study concept and design:* Dell'Oglio, Cacciamani, Galfano.

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*Analysis and interpretation of data:* Dell'Oglio, Cacciamani, Galfano.

*Drafting of the manuscript:* Dell'Oglio.

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## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.euros.2021.01.012>.

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