Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Outreach and Influence of Surgical Societies' Recommendations on Minimally Invasive Surgery During the COVID-19 Pandemic—An Anonymized International Urologic Expert Inquiry

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OBJECTIVE To assess the outreach and influence of the main recommendations of surgical governing bodies on adaptation of minimally invasive laparoscopic surgery (MIS) procedures during the coronavirus disease 2019 (COVID-19) pandemic in an anonymized multi-institutional survey.

MATERIALS AND METHODS International experts performing MIS were selected on the basis of the contact database of the speakers of the Friends of Israel Urology Symposium. A 24-item questionnaire was built using main recommendations of surgical societies. Total cases/1 Mio residents as well as absolute number of total cases were utilized as surrogates for the national disease burden. Statistics and plots were performed using RStudio v0.98.953.

RESULTS Sixty-two complete questionnaires from individual centers performing MIS were received. The study demonstrated that most centers were aware of and adapted their MIS management to the COVID-19 pandemic in accordance to surgical bodies' recommendations. Hospitals from the countries with a high disease burden put these adoptions more often into practice than the others particularly regarding swabs as well as CO2 insufflation and specimen extraction procedures. Twelve respondents reported on presumed severe acute respiratory syndrome coronavirus 2 transmission during MIS generating hypothesis for further research.

CONCLUSION Guidelines of surgical governing bodies on adaptation of MIS during the COVID-19 pandemic demonstrate significant outreach and implementation, whereas centers from the countries with a high disease burden are more often poised to modify their practice. Rapid publication and distribution of such recommendation is crucial during future epidemic threats. UROLOGY 145: 73–78, 2020. © 2020 Elsevier Inc.

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The World Health Organization has recently declared the outbreak of coronavirus disease 2019 (COVID-19) caused by the newly discovered severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) a pandemic, with more than 4 million infected individuals and more than 295,000 deaths to date.[1] Meanwhile, the risk of infection for healthcare professionals (HCP) rapidly grows in many countries. Tragically, in the United States more than 9200 HCP have been infected with COVID-19 and at least 27 have died as of April 9.[2] Currently, a challenging task for national healthcare systems is to provide maximal protection of HCP on the one hand and secure necessary medical services for non-COVID-19 patients on the other. In this context, dissemination and implementation of evidence-based recommendations for a rapid reaction of health care systems to this emergency is ultimately warranted.

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Possible transmission of SARS-CoV-2 during minimally invasive conventional and/or robot-assisted laparoscopic surgery (MIS) is a matter of current expert debate. Evidence has been presented that SARS-CoV-2 RNA is detectable in the blood, urine, stool and gastrointestinal mucosa of infected patients raising the question whether active virus particles can be released and transmitted during laparoscopic urologic surgery on urinary tract and bowel segments.[3-5] In addition, CO2 insufflation together with cautery may foster aerosolization of the virus during MIS.[4,6] Subsequently, it is assumed that exchange of instruments or venting of trocars may further facilitate viral transmission due to sudden bursts of CO2 and surgical smoke. However, there is no immediate evidence for transmissibility of respiratory viruses from the gastrointestinal tract and/or by the CO2-related abdominal route.

The aforementioned concerns about MIS and associated risk of viral transmission to HCP led to safety recommendations published by a number of major surgical societies such as the ERUS (EAU Robotic Urology Section), SAGES (Society of American Gastrointestinal and Endoscopic Surgeons), Royal College of Surgeons (RCS) and most recently SRS (Society of Robotic Surgery).[4,7-9] For instance, ERUS Guidelines offer recommendations for general health and COVID-19 screening prior to surgery, necessary protective measures such as wearing goggles and FFP2/3 masks and utilizing intelligent integrated flow systems to reduce intra-abdominal pressure (8-10 mmHg), thus preventing aerosol dispersal.[8] Furthermore, a critical review of indications is considered in order to reduce HCP in the operating room (OR). As such, interventions with urgent indications should be performed during the pandemic and those with limited risk should be postponed.[8] In addition, it was recommended that MIS be performed by experienced surgeons in order to reduce complications and operative time.

Alterations in the existing policies around MIS cause considerable burden on surgical facilities requiring profound restructuring steps in order to adapt to the COVID-19 pandemic. Thus, the aim of this study was to shed light on the outreach and implementation of the main recommendations for MIS by international senior urologic-oncology surgeons during the current COVID-19 crisis.

MATERIAL AND METHODS

We built a 24-item questionnaire based on the recommendations of ERUS, SAGES and RCS concerning the management of MIS during the COVID-19 pandemic. Speakers of the international Friends of Israel Urology (FOI) Symposium were invited to participate.[10] Only 1 member of any given hospital was contacted in order to exclude repetition of the same data. The contact took place via email containing the link to the questionnaire.

The questionnaire was anonymized in order to more precisely depict delicate issues addressed and open from May 13th to May 16th. Data about burden of COVID-19 infection per country was used to compare countries with a high infection burden vs low and intermediate infection burden. Case load burden per habitants were used to establish the groups by dividing raw data in thirds. Raw data stem from https://www.worldometers.info/coronavirus/ (accessed May 14, 2020). The total cases per 1 million residents and the absolute number of total cases were utilized as 2 surrogates for the national disease burden.

The complete questionnaire is available as supplementary material. Main components consist of general information about the participant (Table S1), patient related management (eg, swabs, surgery on COVID 19 positive patients, surgery on patients suspicious of being COVID-19 carrier), management in the OR (eg, CO2 insufflation, specimen extraction, electrocautery), and staff-related management (eg, reduction of staff in the OR, use of FFP2 masks and protective goggles).

To better depict different risk-adapted strategies among geographical areas, survey results were stratified according to countries with low/intermediate vs high risk COVID19 case burden (Table 1). Descriptive statistic and plots were performed using RStudio v0.98.953 (R Project for Statistical Computing, www.R-project.org).

RESULTS

Overall, 80 physicians answered our questionnaire. Of these 16 do not perform MIS and 2 did not answer the entire questionnaire, allowing for 62 complete questionnaires.

Countries with a low infection burden had a case load of 53-1980 (27.4%), with an intermediate infection burden 1981-3910 (38.7%) and a high infection burden with more than 3910 cases per 1 million inhabitants (33.9%). Countries with low case load were Australia, Brazil, Canada, Israel, Japan, Poland, Russia, and Turkey. Intermediate case load was reported for France, Germany, Italy, Netherlands, Sweden, Switzerland, and the United Kingdom. High case load was reported for the United States, Spain, and Belgium (Fig. 1).

Most participants are members of the AUA (25%), EAU (28.7%), or both (37.5%) and employed in an academic hospital (82.5%) (Table S1). Additionally, most work in Europe (51.6%) and North America (37.1%), followed by Asia (6.5%), Australia (3.2%) and South America (1.6%).

Daily practice has been changed by 90.3% of the respondents during the pandemic, with a nonsignificant difference between countries with low/intermediate case load vs high case load (85.4 vs 100%, $P = .1$). Three participants did not find the proposed modification helpful. The stated reasons were 1x time exposure, 1x associated expenditures and 2x others. Most participants have heard about the recommendations of the EAU and SAGES on MIS (90.3%).

In countries with a high case load significantly more swabs were taken from patients preoperatively ($P = .004$; Fig. 2A). In countries with low/intermediate vs high case load, swabs were never taken in 12.2% vs 0%, only during the highest national burden of pandemic in 17.1% vs 37.1%, always in all patients in 31.7% vs 57.1%, and only in symptomatic patients in 39% vs 4.8% (all $P = .004$).

71% do not perform MIS in COVID-19 positive patients (68.3% vs 76.2% in low/intermediate and high burden countries, respectively), whereas 19.4% did not have COVID-19 positive patients yet (22% vs 14.3%) (all $P = .2$). Only 2 respondents performed MIS in COVID-19 positive patients. About 77.4% do not perform MIS in COVID-19 suspicious patients (73.2% vs 85.7%), whereas 11.3% did not have COVID-19 suspicious patients yet (14.6% vs 4.8%) (all $P = .5$). No difference was reported between low/intermediate case load

Table 1. Questionnaire results stratified according to low/intermediate and high* COVID19 case load per 1 million inhabitants in the country of residence of the respondent

Variables	Overall	Low/Intermediate Case Load	High Case Load	*P* Value
n (%)	64 (100)	41 (66.1)	21 (33.9)	
Did you change your practice during pandemic?				*P* = .1
Yes	56 (90.3)	35 (85.4)	21 (100)	
No	6 (9.7)	6 (14.6)	0 (0)	
Have you heard about recommendations of the EAU and SAGES on MIS during COVID pandemic?				*P* = .2
Yes	56 (90.3)	39 (95.1)	17 (81)	
No	6 (9.7)	4 (19)	2 (4.9)	
Did/Do you perform swabs in all patients?				*P* = .004
No	5 (8.1)	5 (12.2)	0 (0)	
Yes, during the highest national burden of COVID-19 pandemic	15 (24.2)	7 (17.1)	8 (38.1)	
Yes, permanently since the start of the pandemic	25 (40.3)	13 (31.7)	12 (57.1)	
Only in symptomatic patients/in patients with suspicion of COVID-19	17 (27.4)	16 (39)	1 (4.8)	
Did/Do you perform MIS in COVID-19 positive patients?				*P* = .2
No	44 (71)	28 (68.3)	16 (76.2)	
We did not have COVID-19 positive patients yet	12 (19.4)	9 (22)	3 (14.3)	
Yes, in patients with a previously known infection with COVID-19	2 (3.2)	0 (0)	2 (9.5)	
Yes, in patients with undetected infection (turned out to be positiv within 10 days postsurgery)	2 (3.2)	2 (4.9)	0 (0)	
Yes, both	2 (3.2)	2 (4.9)	0 (0)	
Did/do you perform MIS in COVID-19 suspicious patients (symptomatic or contact to COVID-19 positives)				*P* = .5
Yes	7 (11.3)	5 (12.2)	2 (9.5)	
No	48 (77.4)	30 (73.2)	18 (85.7)	
We did not have COVID-19 suspicious patients yet	7 (11.3)	6 (14.6)	1 (4.8)	
Have you reduced MIS with bowel opening (eg, neobladder/conduit in cystectomy)?				*P* = .2
Yes	7 (11.3)	6 (14.6)	1 (4.8)	
No	29 (46.8)	16 (39)	13 (61.9)	
We do not perform such procedures	26 (41.9)	19 (46.3)	7 (33.3)	
Are you utilizing CO2 insufflation with a closed system with appropriate filtering of aerosolized particles?				*P* = .01
No	18 (29)	17 (41.5)	1 (4.8)	
Yes. as change of practice during pandemic	12 (19.4)	6 (14.6)	6 (28.6)	
Yes. as standard procedure prior pandemic	32 (51.6)	18 (43.9)	14 (66.7)	
Are you turning CO2 insufflation off and venting the gas through a filter prior to specimen extraction?				*P* = .003
No	18 (29)	13 (31.7)	5 (23.8)	
Yes. as change of practice during pandemic	27 (43.5)	12 (29.3)	15 (71.4)	
Yes. as standard procedure prior pandemic	17 (27.4)	16 (39)	1 (4.8)	
Have you lowered electrocautry power in MIS during pandemic?				*P* = .4
No	51 (82.3)	32 (78)	19 (90.5)	
Yes	11 (17.7)	9 (22)	2 (9.5)	
Have you reduced the number of the present OR staff (students, fellows etc.) during pandemic?				*P* = .2
No	13 (21)	11 (26.8)	2 (9.5)	
Yes	49 (79)	30 (73.2)	19 (90.5)	
Did/Does OR stuff with immediate patient contact wear FFP2 masks during pandemic?				*P* = .2
No	9 (14.5)	2 (9.5)	7 (17.1)	
Yes. in COVID-19 positiv patients	20 (32.3)	10 (47.6)	10 (24.4)	
Yes. regularly in all patients	33 (53.2)	9 (42.9)	24 (58.5)	
Did/Does OR stuff with immediate patient contact wear protection goggles during pandemic?				*P* = .058
No	6 (9.7)	6 (14.6)	0 (0)	
Yes. in COVID-19 positiv patients	11 (17.7)	9 (22)	2 (9.5)	
Yes. regularly in all patients	45 (72.6)	26 (63.4)	19 (90.5)	
Have you experienced any presumed cases of COVID-19 transmission during MIS (patients or stuff)?				*P* = .6
No	49 (79)	31 (75.6)	18 (85.7)	
Yes	12 (19.4)	9 (22)	3 (14.3)	

EAU, European association of urology; MIS, minimal invasive procedure; OR, operating room; SAGES, Society of American Gastrointestinal and Endoscopic Surgeons.

* Countries with high case load had more than 3910 cases per million habitants.

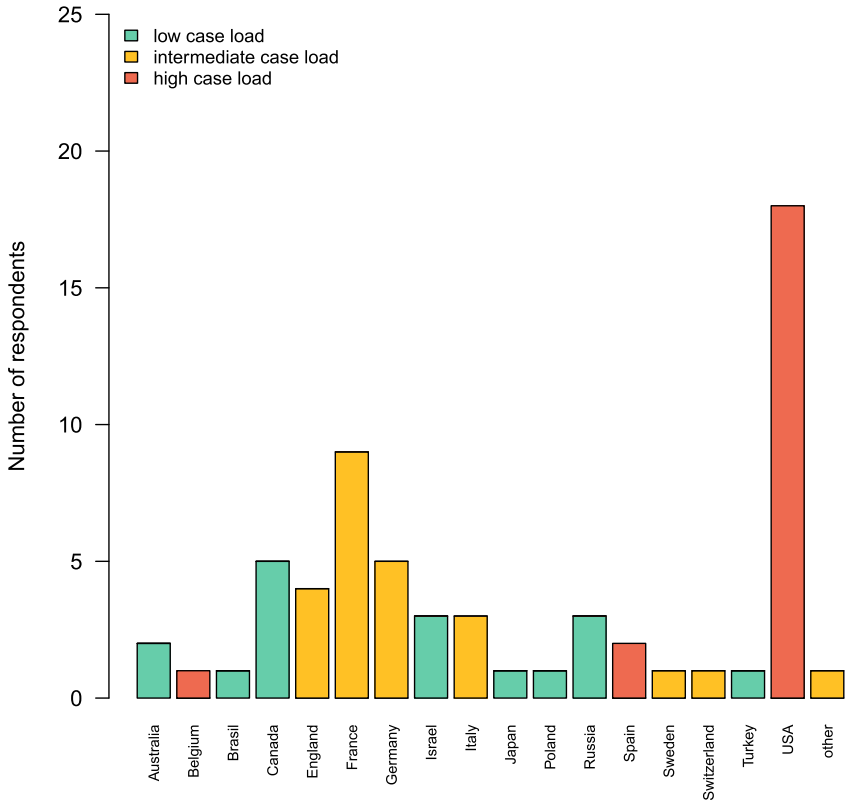

Figure 1. List of the respondent countries stratified according to the national COVID19 disease burden (total number of cases per 1 million inhabitants).

vs high case load countries regarding MIS with bowel opening (eg, neobladder/conduit). About 41.9% do not perform such procedures, 11.3% (14.6% vs 4.8%) reduced and 46.8% (39% vs 61.9%) did not reduce such procedures (all $P = .2$).

A significant proportion changed their practice regarding CO2 insufflation. Overall 19.4% (14.6% low/intermediate case load vs 28.6% high case load $P = .01$) introduced a closed air system with filtering (Fig. 2B) and 43.5% (29.3% vs 71.4%, $P = .003$) turned CO2 insufflation off prior to specimen extraction (Fig. 2C). A low proportion reduced electrocautery power in MIS during the pandemic (overall 17.7%, 22% vs 9.5%, $P = .4$).

Staff reduction in the OR was performed in 79% with a non-significant difference between low/ intermediate case load vs high case load (73.2% vs 90.5%, $P = .2$). About 53.2% wear FFP2 masks in all patients, whereas 32.3% only wear these masks in COVID-19 positive patients. In low/intermediate vs high case load countries 63.4% vs 90.5% wear protective goggles in all patients ($P = .058$). Overall 19.4% experienced presumed cases of COVID-19 transmission during MIS (Table 1).

Virtually the same results were reported when stratifying according to total deaths per million inhabitants (data not shown).

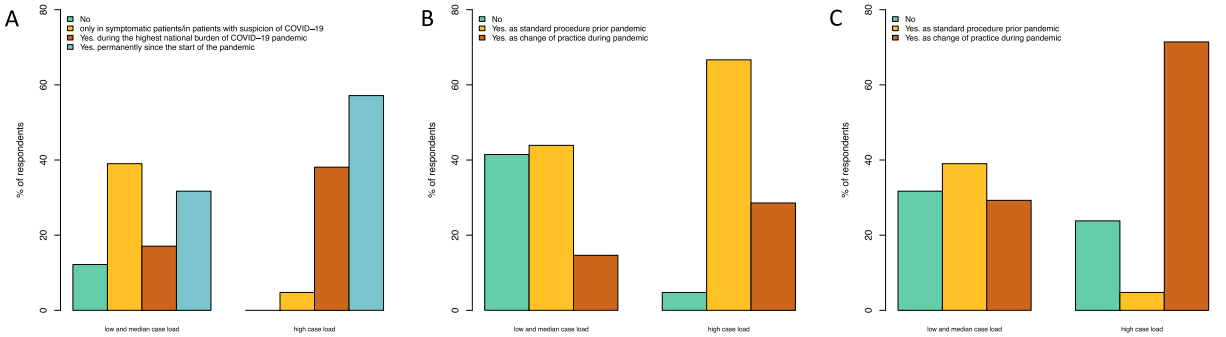

Figure 2. (**A**) Distribution of respondent answers to the question "Did/do you perform swabs prior to surgery?" stratified by disease burden. (**B**) Distribution of respondent answers to the question "Are you utilizing CO2 insufflation with a closed system with filtering of aerosolized particles?" stratified by COVID19 disease burden. (**C**) Distribution of respondent answers to the question "Are you turning CO2 insufflation off and venting the gas through a filter before specimen extraction?" stratified by COVID19 disease burden.

DISCUSSION

The COVID-19 pandemic represents a social challenge like none other than we have experienced since World War 2, inflicting long-term consequences on many areas of human life. Since HCP are at the forefront of the combat against this dangerous disease with multiple potential opportunities for exposure from infected patients each day, health protection measures for HCP are of utmost importance in managing the pandemic.[11] Even if the risk of COVID-19 transmission in the primary care setting was recently estimated to be low for HCP,[12] it might significantly increase for OR staff particularly in close proximity to the patient.[13] These concerns have led to a number of safety measures being recommended by surgical societies to prevent infection with SARS-CoV-2 in the OR.[13] Notably, most of these recommendations are based on a very low level of evidence and have been predominantly extrapolated from the findings derived from other epidemics. Reliable risk quantification is not possible.[4,13]

The main concern related to MIS is that besides anesthesiologic personnel exposed to respiratory tract aerosol during anesthetic procedures, surgeons and nurses may also be endangered by exposure to CO2 deflation mixed with surgical plume potentially transferring infectious aerosolized SARS-CoV-2 particles released by electrocautery, laser surgery or ultrasonic devices.[4,14] However, there is not yet any data that demonstrates that CO2 aerosol can transport virions or induce an active infection with SARS-CoV-2. A contemporary review yielded no convincing data that surgical smoke emerging from the treatment of human papillomavirus (HPV)—related lesions results in a higher incidence of HPV-related diseases in OR staff even though the HPV DNA could contaminate their upper airways.[15] Of note, HPV virion size is similar to that of SARS-CoV-2 (55 vs 60-140 nm).[16,17] In concert with this data, hepatitis B virus was detectable in surgical smoke during laparoscopic surgery, but no solid evidence exists that this can cause airborne infections.[18] In addition, active virus particles have never been isolated from the blood or urine of SARS-CoV-2 infected patients.[19] Interestingly, a recent case report showed no infection of a patient with severe aplastic anemia who received apheresis platelet transfusion from a donor subsequently diagnosed with COVID-19.[20] Nonetheless, given a still limited experience with this dangerous condition, safety measures including patient testing, personal protection equipment for HCP, adaptation of surgical technique (filters, precautions during the exsufflation of the pneumoperitoneum, instrument use or change) and organization of the operating room are essential.[21]

In our study, practical management of MIS during the COVID-19 pandemic was investigated based on the data of respondents from 64 centers on 5 continents performing minimally invasive conventional and/or robot-assisted laparoscopic procedures. Given that 98.4% of participants were members of the 2 biggest international urologic associations and 91.2% of their national urologic associations, it can be assumed with a high degree of certainty that they were sufficiently supplied with the COVID-19 related information relevant for urologic practice. In addition, professional activity of 90.6% of the responding physicians at an academic hospital supports their up-to-date knowledge of the local COVID-19 related epidemiologic situation and respective health care measures.

Importantly, 90.3% of the responding participants modified their MIS handling during the pandemic. This practice change was undertaken independently of the national disease burden emphasizing a high concern of the centers about health protection of their OR staff. Fortunately, 90.3% of the participants were informed of the recommendations of the EAU and SAGES on MIS during the COVID-19 pandemic.[7,8] This finding is encouraging and can be interpreted as proof of a high outreach and influence of recommendations published by surgical societies since March 2020.

Of note, less than half of the participating centers perform swabs in all patients undergoing MIS, while a significantly higher proportion was observed among hospitals from the countries with a high national disease burden than from those with a low/intermediate case load. Porter et al. recently recommended preoperative testing prior to MIS in all patients.[4] Those tested positive should be postponed if clinically justifiable, while COVID-19 negative individuals should be managed with appropriate safety measure due to uncertain sensitivity of testing.[4] This is in line with the finding of our study that 71% of centers do not perform MIS in COVID-19 infected and 77.4% in COVID-19 suspicious patients.

Interestingly, only 7 out of 36 centers performing MIS with bowel opening have reduced this procedure despite society recommendations for example those of ERUS.[8] However, until the gap of knowledge can be filled about possibility of the faecal—oral or—respiratory transmission of the virus, surgery on the gastrointestinal tract should be performed with caution.[22] Alarmingly, Tan and colleagues reported that SARS-CoV-2 nucleocapsid protein was detected in gastrointestinal epithelial cells and infectious virus particles were isolated from faeces, thus making them potentially infectious.[23]

Notably, 71% of the centers utilize CO2 insufflation with a closed system and appropriate filtering of aerosolized particles as well as turning CO2 insufflation off and venting the gas through a filter prior to specimen extraction. Once again, significantly more hospitals adopted these steps in the countries with a high disease burden during the COVID-19 pandemic. On the contrary, only every fifth center lowered cautery during MIS in response to the outbreak. With regards to OR personnel, most centers decreased the number of the OR staff and instructed them to wear FFP2 masks and protective goggles during all MIS. Of note, 12 respondents stated to have experienced presumed cases of COVID-19 transmission during MIS. Since reliable information on this particular issue requires precise verification by local hygiene commissions

and health authorities, we refrained from deepening inquiries on this aspect in the survey.

Our study has several limitations. First, there is an unbalanced distribution of participating centers per country and continent. Second, we have captured primarily academic institutions, so that we cannot comment on practices in other hospitals. Third, selection bias exists for the participants of the study due to the underlying contact database. Fourth, reported COVID-19 cases presumably attributable to SARS-CoV-2 transmission during MIS cannot be independently verified and derived consequences for the in-house practice and affected individuals are unknown. Finally, disease burden stratification is a rapidly changing state depending on the time of the questionnaire.

To the best of our knowledge, this is the first report assessing outreach and implementation of the main society guidelines on the management of MIS during the COVID-19 outbreak. Participants of this anonymized survey performing MIS were key opinion leaders from different countries serving as speakers for the FOI Urology Symposium. The study could demonstrate that most centers adapted their MIS management to the COVID-19 pandemic in accordance to the recommendations of surgical societies. Hospitals from the countries with a high disease burden put these adoptions more often into practice than those with low/intermediate burden. Reported putative SARS-CoV-2 transmission during MIS should be interpreted with caution and serve as an issue meriting further research.

CONCLUSION

Guidelines of surgical societies on adaptation of MIS during the COVID-19 pandemic have achieved significant outreach and have influenced practice around the world. Centers in countries with a high COVID19 disease burden have modified their practice the most. Rapid publication and distribution of such recommendation will be crucial during future epidemics.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.urology.2020.07.043.

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