Message from the ERUS-Chair:

Below, you will find the ERUS Guidelines on dealing with robotic surgery during COVID-19 Pandemic. Due to time constraints, a rigorous review process has not been possible. These guidelines are the results of the scientific evidence present and are to be seen as a consensus of taking in account that all should be done to safeguard healthcare workers and optimal treatment for the patients.
I want to thank my co-workers Dr. Stefano Puliatti and Dr. Elio Mazzone for the great work in these guidelines

Prof. Dr. A. Mottrie
On behalf of the EAU Robotic Urology Section

ERUS (EAU Robotic Urology Section) guidelines during COVID-19 emergency

Alex Mottrie

The Coronavirus disease 2019 (COVID-19) has been declared a pandemic on March 11, 2020. At the time of writing, the total number of confirmed cases worldwide is 332.930, with a total number of deaths of 14.510 cases[1].

These dramatic figures have a deep impact on the healthcare systems worldwide that must quickly change medical practice to face this unprecedented emergency with two key aims:

1) Maximal protection of health care professionals. In Italy, among 69,176 cases, 4,824 involve health professionals[2]. While some of these cases are related to direct care caring for COVID-19 patients it is possible that also non-diagnosed, asymptomatic but contagious COVID-19 patients might act as vector during laparoscopic and robotic procedures. It is therefore key to protect surgeons from the latter risk.

2) Minimal collateral damage for the patients requiring care for any non-COVID-19 condition. For example, the COVID-19 emergency might lead to a delay in surgical treatment of non-emergent cases and in the setting of urological surgery, this might increase the risk of risk sub-optimal oncologic outcomes in cancer cases or the risk of infection and urosepsis in. other cases.

In this regard, the EAU Robotic Urology Section (ERUS) cannot refrain from proposing recommendations, based on the most recent scientific pieces of evidence, to safeguard the health of healthcare workers and their patients, in the context of robotic surgery.

The following guidelines are aimed at providing recommendations to the urologic robotic community based on the available evidences. Robotic surgeons are invited to apply the following recommendations in their centres when performing procedures on patients potentially or proven COVID-19 positive.

1. **General protection**. All patients should receive preoperative health screening, regardless if they are symptomatic or not. As operating staffs might become infected, and therefore reduced in number, all medical personnel have to comply with the tertiary protection regulations. General health and COVID screening should be performed in all patients candidate to undergo minimally invasive surgery. In case of COVID+ patient, the procedure should be postponed if not emergent. However, urologists practicing in hospitals treating COVID-19 patients may be in need to perform urgent procedures on those patients. In these cases, procedures should be performed in dedicated operating room (OR) following the hospital recommendation for OR staff protection. In case of negative COVID result, considering also the possibility of false negative, all the necessary protection tools and general recommendation to reduce COVID transmission need to be adequately followed[3].

2. **Patient selection**. In order to ensure an adequate number of medical personnel involved in the COVID-19 emergency, as well as in emergencies other than those related to COVID-19, including internists, anaesthesiologists, or nurses, all elective surgery that can be delayed without any risk for the patient should be postponed (Table). Moreover, this measure is aimed at minimizing the expenditure of medical equipment, useful to deal with the COVID-19 emergency, such as masks, sanitizing gel or beds for SARS-CoV-2+ patients, as well as to ensure the ordinary course of emergency cases requiring the use of operating rooms and intensive care units[4].

3. **Prevention and management of aerosol dispersal**. In the case of non-deferrable surgery, the release of surgical smoke during laparoscopic procedures may carry small viral particles [5,6]. In consequence, any laparoscopic or robotic surgery should only be performed when needed. It may be of particular importance to perform robotic surgery at the lowest intra-abdominal pressure allowed. In this regard, the use of intelligent integrated flow systems is recommended. Indeed, the use of these devices allows the surgeon to keep the intra-abdominal pressure as low as possible, ensuring a self-maintained constant pneumoperitoneum. Avoid using two-way pneumoperitoneum insufflators to prevent pathogens colonization of circulating aerosol in pneumoperitoneum circuit or the insufflator. These integrated flow systems need to be configured in a continuous smoke evacuation and filtration mode [7]. Specifically, through a Ultra Low Penetrating Air (ULPA) Filter that meets the AORN guidelines [8], the smoke evacuation

and filtration mode allow capturing of particles above 0.01 mcm and the SARS-CoV-2 aerodynamic size has been reported in the range of 0.06-0.14 mcm [9]. In consequence, it is noteworthy that the use of devices with smoke evacuation filters may have a role in reducing the diffusion of SARS-CoV-2. However, it is important to remark that there is no specific data demonstrating an aerosol presence of the COVID-19 virus released during minimally invasive abdominal surgery, as reported in recent SAGES guidelines update [7].

4. **Operation technique**. As reported by Zheng et al [10], ultrasonic scalpels or electrical equipment commonly used in minimally invasive surgery can easily produce large amounts of surgical smoke, and in particular, the low-temperature aerosol from ultrasonic scalpels or scissors cannot effectively deactivate the cellular components of virus in patients. In previous studies, activated Corynebacterium, papillomavirus and H.I.V. have been detected in surgical smoke [11–13] and several doctors contracted a rare papillomavirus [14] suspected to be connected to surgical smoke exposure. The risk of COVID-19 infection aerosol should not be any exception. One study found that after using electrical or ultrasonic equipment for 10 minutes, the particle concentration of the smoke in laparoscopic surgery was significantly higher than that in traditional open surgery [15]. Thus, it is recommended lowering electrocautery power setting as much as possible.

5. **Pneumoperitoneum disinflation**. In addition to the previous point, it is mandatory to confirm the complete and correct disinflation of the pneumoperitoneum at the end of the procedure. In fact, due to the low gas mobility in the pneumoperitoneum, the aerosol formed during the operation tends to concentrate in the abdominal cavity [10]. Sudden release of trocar valves, non-airtight exchange of instruments or even small abdominal extraction incisions can potentially expose the health care team to the pneumoperitoneum aerosol. This evidence further supports the use of system with integrated active smoke evacuation mode [7]. Conversely, classical insufflation systems that are not implemented with active smoke evacuation mode or other filters may expose to higher risk of SARS-CoV-2 aerosol transmission.

6. **Surgical technique**. The adoption of a standardized surgical technique is recommended in order to reduce the operating room time, the risk of postoperative complications and the resources utilization. To achieve this goal, all minimally invasive procedures should be preferably performed by experienced surgeons, outside of their learning curve [3]. Procedures should be performed with the minimum number of OR staff members required. Possibly, all the OR members should be fully trained and experienced. Additionally, no external observer is allowed in the OR. Surgical training fellowships should be temporarily suspended. Fellows are discouraged to physically attend surgical procedures until the end of the COVID-19 emergency.

7. **Fecal transmission**. It is now reported that SARS-CoV-2 is present in the stools of COVID-19 patients, but the transmission during laparoscopic procedures has not been described, and faecal-oral transmission has not

been reported, although theoretically possible [3,16]. In consequence, even if clear evidence of COVID-19 virus spreading in aerosol from feces is not demonstrated yet, it is preferable to minimize bowel handling and opening during urological procedures in order to reduce the risk virus diffusion with CO2 insufflation mode.

8. **Urinary transmission**. Similarly, a recent study by Ling et al. reported limited persistence of SARS-CoV-2 nucleic acid in urine [17]. This data does not clearly justify a correlation between urine spillage and virus transmission in the aerosol during robotic procedures. However, although no evidence of disease transmission through the urine is demonstrated, urethral or ureteral catheterization during the laparoscopic and robotic procedures should be executed with caution, particularly if pneumoperitoneum is already induced.

9. **Renal transplantation**. Possible risks associated to transplant in COVID-19 positive recipients are described by Michels et al. for liver transplantation [18]. Given the lack of specific recommendation for kidney transplant surgery, we suggest adopting the same approach proposed for liver transplantation. Specifically, renal transplantation should be performed only in the most urgent cases. All recipients need to be screened to avoid transplantation in SARS-CoV-2 positive subjects [19]. Donors should also be COVID negative. As previously stated, no clear evidence of SARS-CoV-2 transmission through aerosol generated during minimally invasive surgery is currently available [7]. In consequence, no specific indication regarding the use of minimally invasive techniques for renal transplantation can be offered.

10. **Operating staff protection**. All the surgical team (including surgeons, anesthetists and nurses) should adopt adequate protection devices. Goggles, FFP2/3 mask and body protective garb represent necessary tools in case any minimally invasive procedure performed during the COVID-19 emergency. Surgeons must avoid contact with droplets and full body protection is needed. This may also mean wearing a sealed visor mask for the console surgeon and thorough cleaning of the head support of the console between cases.

Important Note: Considering the rapidly evolving scenario of COVID pandemic, this guidance for minimally invasive surgery may change and evolve.

Table. Grading of priority urological interventions in the context of the COVID-19 epidemic [20]

Stage 1 **High recommendation to postpone**	**Stage 2** **Medium recommendation to postpone**	**Stage 3** **Weak recommendation to postpone** (Severe Symptoms / Aggressive Oncological Pathology)	**Stage 4** **Urgency** (Organ-threatening / life-threatening**)**
Functional & reconstructive robotic surgery	Robotic Cystectomy (lower risk cancers)	Robotic Cystectomy (higher risk cancers)	Robotic Cystectomy in severe haematuria with transfusion distress
Robotic Radical prostatectomy (low risk)	Robotic Radical prostatectomy (high risk)	Robotic Radical cystectomy / Radical prostatectomy at strict timing after systemic therapy (chemo, neo-adjuvant ADT in a study context)	Postoperative complications that can be managed with robotic approach in centres highly specialized in this technique
Robotic radical Nephrectomy for benign pathologies	Robotic Partial nephrectomy (for tumour $\leq$ cT1b)	Robotic Partial or Radical nephrectomy (for tumour $\geq$ cT2a)	Robotic Radical Nephrectomy of bleeding kidney or of bleeding kidney tumour
	Robotic Nephroureterectomy (low risk)	Robotic Nephroureterectomy (high risk)	
		Robotic adrenalectomy	

References

1. WHO Report. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports. .
2. . https://www.ilsole24ore.com/art/un-contagio-dieci-%0Amedici-e-infermieri-trincea-mascherine-inadatte-e-pochi-tamponi-ADqwiFF.
3. Ficarra V, Novara G, Abrate A, et al. Urology practice during COVID-19 pandemic. *Minerva Urol Nefrol*. 2020. doi:10.23736/S0393-2249.20.03846-1
4. Disease C. COVID-19 : Recommendations for Management of Elective Surgical Procedures. 2019.
5. Kwak HD, Kim S-H, Seo YS, Song K-J. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. *Occup Environ Med*. 2016;73(12):857 LP - 863. doi:10.1136/oemed-2016-103724
6. Sawchuk WS, Weber PJ, Lowy DR, Dzubow LM. Infectious papillomavirus in the vapor of warts treated with carbon dioxide laser or electrocoagulation: detection and protection. *J Am Acad Dermatol*. 1989;21(1):41-49. doi:10.1016/s0190-9622(89)70146-8
7. https://www.sages.org/recommendations-surgical-response-covid-19/.
8. AORN Guidelines. https://www.aorn.org/about-aorn/aorn-newsroom/periop-today-newsletter/2019/2019-articles/guideline-revisions-for-2020.
9. Cascella M, Rajnik M, Cuomo A et al. *Features, Evaluation and Treatment Coronavirus (COVID-19) [Updated 2020 Mar 8].*; 2020.
10. Zheng MH, Boni L, Fingerhut A. Minimally invasive surgery and the novel coronavirus outbreak: lessons learned in China and Italy. *Ann Surg*. 2020;(In Press).
11. Capizzi PJ, Clay RP, Battey MJ. Microbiologic activity in laser resurfacing plume and debris. *Lasers Surg Med*. 1998;23(3):172-174. doi:10.1002/(sici)1096-9101(1998)23:3<172::aid-lsm7>3.0.co;2-m
12. Hensman C, Baty D, Willis RG, Cuschieri A. Chemical composition of smoke produced by high-frequency electrosurgery in a closed gaseous environment. An in vitro study. *Surg Endosc*. 1998;12(8):1017-1019. doi:10.1007/s004649900771
13. Johnson GK, Robinson WS. Human immunodeficiency virus-1 (HIV-1) in the vapors of surgical power instruments. *J Med Virol*. 1991;33(1):47-50. doi:10.1002/jmv.1890330110
14. Gloster HMJ, Roenigk RK. Risk of acquiring human papillomavirus from the plume produced by the carbon dioxide laser in the treatment of warts. *J Am Acad Dermatol*. 1995;32(3):436-441. doi:10.1016/0190-9622(95)90065-9
15. Li C-I, Pai J-Y, Chen C-H. Characterization of smoke generated during the use of surgical knife in laparotomy surgeries. *J Air Waste Manag Assoc*. 2020;70(3):324-332. doi:10.1080/10962247.2020.1717675
16. Yeo C, Kaushal S, Yeo D. Enteric involvement of coronaviruses: is faecal-oral transmission of SARS-CoV-2 possible? *lancet Gastroenterol Hepatol*. 2020;5(4):335-337. doi:10.1016/S2468-1253(20)30048-0
17. Ling Y, Xu S-B, Lin Y-X, et al. Persistence and clearance of viral RNA in 2019 novel coronavirus disease rehabilitation patients. *Chin Med J (Engl)*. February 2020. doi:10.1097/CM9.0000000000000774
18. Michaels MG, La Hoz RM, Danziger-Isakov L, et al. Coronavirus disease 2019: Implications of emerging infections for transplantation. *Am J Transplant*. 2020;n/a(n/a). doi:10.1111/ajt.15832
19. Dondossola D, Gori A, Antonelli B, et al. Coronavirus Disease 2019 and Transplantation: a view from the inside. *Am J Transplant*. 2020:0-2. doi:10.1111/ajt.15853
20. . https://bvu.be/nl/nieuws/gradering-prioriteit-urologische-ingrepen-wegens-covid-19-epidemie.