

## ORIGINAL ARTICLE

# IMPLICATIONS OF COVID-19 PANDEMIC ON LAPAROSCOPIC AND ABDOMINAL SURGERY FOR BENIGN ADNEXAL CONDITIONS – SINGLE CENTER EXPERIENCE

✉ Milan Dokić<sup>1</sup>, Branislav Milošević<sup>1,2</sup>, Jelena Dotlić<sup>1,2</sup>, Teodora Đerić<sup>1</sup>, Luka Andrić<sup>1</sup>, Sandra Babić<sup>1</sup>, Dragiša Šljivančanin<sup>1,2</sup>

<sup>1</sup> Clinic for Gynecology and Obstetrics, University Clinical Centre of Serbia, Belgrade, Serbia

<sup>2</sup> University of Belgrade, Faculty of Medicine, Belgrade, Serbia

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#### ✉ Correspondence to:

Milan Dokić, MD, PhD, Ob/Gyn

Clinic for Gynecology and Obstetrics

University Clinical Centre of Serbia

26, Dr Koste Todorovica Street, 11000 Belgrade, Serbia

Tel: +381 11 361 55 92

Fax: +381 11 361 56 03

E-mail: milanddokić@gmail.com

## Summary

**Introduction/Aim:** COVID-19 pandemic posed a challenge in patient treatment and caused problems in the organization of health systems in many countries. The study aimed to analyze and quantify the influence of COVID-19 pandemic on performing surgeries for benign adnexal conditions with classic (open abdominal) and minimally invasive (laparoscopic) approach at the Clinic for Gynecology and Obstetrics University Clinical Center of Serbia.

**Material and Methods:** The study retrospectively analyzed all patients who were operated due to benign adnexal masses at our Clinic during the past five years. We compared numbers and types of operations before and during the pandemic.

**Results:** The study included 2166 patients who significantly more often had laparoscopic (61.9%) than open surgeries (38.1%). Surgeries of benign adnexal masses were elective in 53.2% cases, whereas in 46.8% cases those were emergency surgeries. Before the pandemic laparoscopic surgeries (mostly cystectomies) were on the rise. A reduction in laparoscopic and open surgeries was seen in the year 2020 ( $p=0.001$ ). Moreover, the majority of surgeries were emergency surgeries (76.2%;  $p=0.001$ ). Nevertheless, this decrease was significant only for laparoscopic cystectomies ( $p=0.001$ ), but not for adnexectomies ( $p=0.224$ ) and salpingectomies ( $p=0.762$ ). Likewise, the 2020 reduction in open cystectomies ( $p=0.073$ ), adnexectomies ( $p=0.836$ ) and salpingectomies ( $p=0.241$ ) was not significant either. During 2021, the number of surgical procedures for benign adnexal masses started to rise again ( $p=0.023$ ). No intra-hospital COVID-19 infections were registered.

**Conclusion:** The total number of operations of benign adnexal masses in our Clinic decreased and was limited to emergencies, which was mostly reflected in minimally invasive surgery.

**Keywords:** COVID-19, gynecological surgery, adnexal pathology, laparoscopy, laparotomy

## INTRODUCTION

Coronavirus (SARS-COV-2) affected almost the entire world in just a few months and it was affecting it for more than two years. It posed not only challenge in patient treatment but also caused problems in the organization of health systems in many countries (1, 2). COVID-19 patients overcrowded hospitals which produced numerous organizational challenges. Intensive care units and other perioperative facilities became clinical care units for COVID-19 patients. These additional units also required staff. Therefore, many practitioners such as general and internal medicine specialists, surgeons, anesthesiologists along with nurses and support personnel were transferred to provide support in these new COVID-19 units (3).

To allow utilization of necessary technical resources and personnel for the treatment of COVID-19 patients, the majority of eminent medical societies recommended postponing nonessential medical visits and prioritizing only emergency surgeries while delaying elective surgeries of benign diseases and attempting alternative medical management wherever possible (4, 5). Nevertheless, the issue of health impairment due to postponed elective procedures, forced health care systems to adapt to the fluctuation of COVID-19 incidence and find a balance in the treatment of COVID-19 patients and non-COVID-19 patients. Consequently, in the past year more and more elective surgeries are again performed including gynecological surgeries (6).

There is another discussion regarding the optimal surgical approach to both emergency and elective surgeries. Some early recommendations indicated that laparotomy should be performed instead of laparoscopy in both emergency and elective conditions to avoid potential risk of virus dissemination in the operating theater during surgery due to the use of gas insufflation, possibility of gas leakage and creation of aerosols from electro-surgery (7). However, studies showed that there was no strong evidence to support claims that laparoscopy increased and open surgery prevented spreading of COVID-19 infection. Therefore, leading medical societies currently recommend the use of minimally invasive procedures whenever indicated and whenever possible (8).

The situation with organizing healthcare system during pandemic was similar in Serbia as we followed all current recommendations. This exceptional emergency situation affected the organization of gynecological

services as well, especially surgical treatment of non-COVID patients with benign conditions requiring vaginal and laparoscopic operations. However, there are still no empirical data of the effect of pandemic on gynecological surgery in Serbia.

The aim of this study was to analyze and quantify the influence of COVID-19 pandemic on performance of surgeries for benign adnexal conditions with classic (open abdominal) and minimally invasive (laparoscopic) approach at a regional tertiary referral center – Clinic for Gynecology and Obstetrics University Clinical Center of Serbia.

## MATERIAL AND METHODS

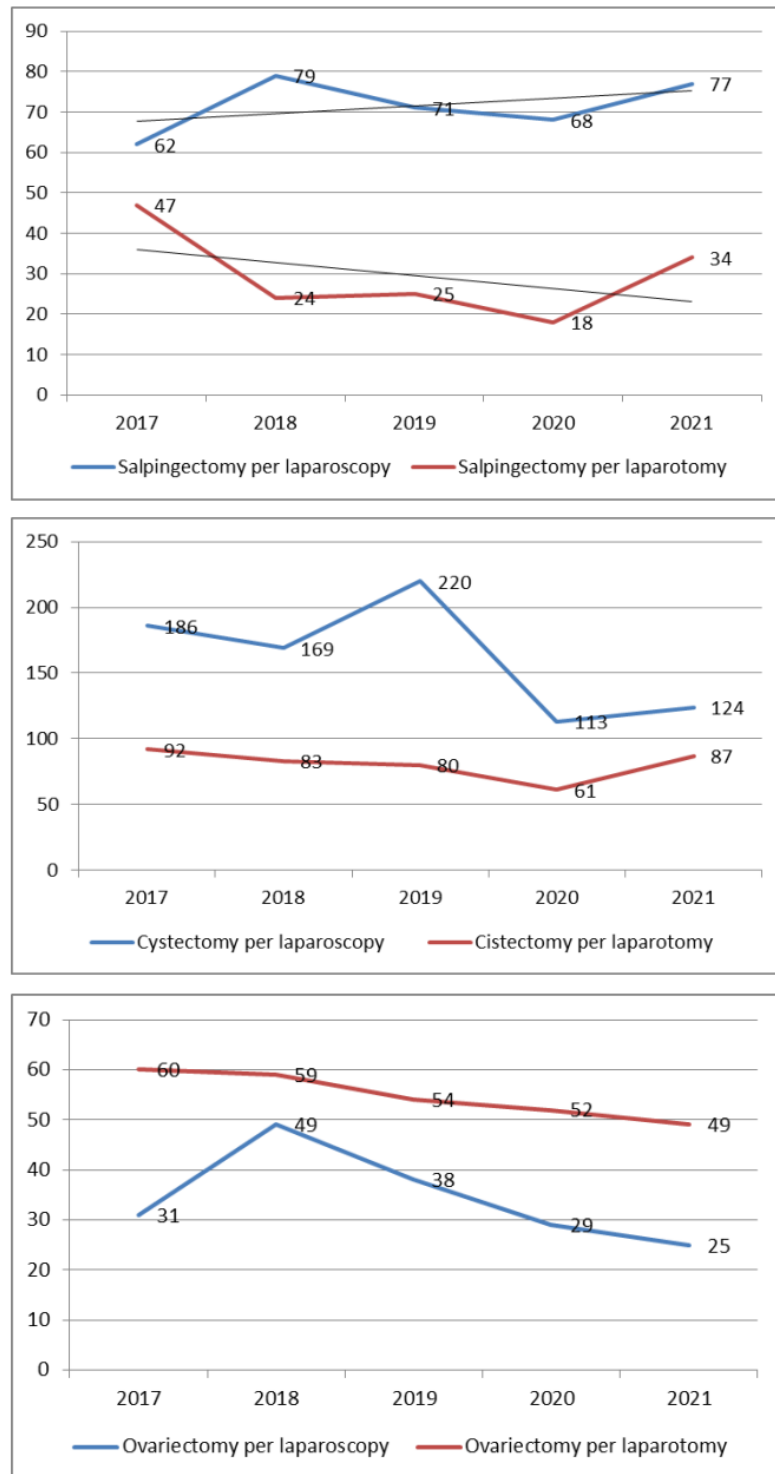
This retrospective study was performed at the Clinic for Gynecology and Obstetrics University Clinical Center of Serbia over the period of the past five years (2017 to 2021 year). The study conforms to the legal standards and was approved by the Ethics' Committee of the clinic. The study included all patients who were operated due to histopathologically confirmed benign adnexal masses. They were divided into groups according to the year when the operation was performed (before and after COVID-19 pandemic onset: 2017-2019 and 2020-2021) as well as into subgroups according to the surgical approach (open or laparoscopic). Patients' general data (age, Body Mass Index – BMI), indication and type of procedures, number of days in hospital, as well as postoperative complications including intra-hospital infection with COVID-19 were taken from medical records (medical histories and operative protocols). Patients' data were kept confidential and only researchers had access to them. The obtained data were analyzed by methods of descriptive (frequency, percent, mean, standard deviation) and analytical statistics ( $\chi^2$  test, t-test) and using the SPSS 20 software.

## RESULTS

Study included 2166 patients who on average had 35.3 +/-9.7 years of age. The examined patients were obese ( $BMI \geq 25 \text{ kg/m}^2$ ) in just 6.4% ( $p=0.001$ ) of cases. Overall significantly more patients had laparoscopic surgery (1341; 61.9%) than open approach surgery (825; 38.1%) (Table 1).

**Table 1.** Frequency of performed surgeries per year

Surgery indication and approach	2017	2018	2019	2020	2021	Total	
Salpingectomy	laparoscopy	62	79	71	68	77	357
	open	47	24	25	18	34	148
Cystectomy	laparoscopy	186	169	220	113	124	812
	open	92	83	80	61	87	403
Ovariectomy and/or adnexectomy	laparoscopy	31	49	38	29	25	172
	open	60	59	54	52	49	274
Total	478	463	488	341	396	2166	



**Figure 1.** Total number of surgeries for benign adnexal masses per year

Furthermore, throughout the analyzed period all types of surgery were significantly more often performed with laparoscopic surgery than with open approach (cystectomies  $p=0.011$ , salpingectomies  $p=0.004$  and adnexectomies  $p=0.004$ ). Surgery of adnexal masses in our sample was elective in 53.2% of cases and due to emergency conditions in 46.8% ( $p=0.284$ ) of cases. The emergency of surgery did not affect the choice of surgical approach ( $p=0.145$ ). Still, women who were obese ( $p=0.023$ ) were more often operated using the open approach.

Before the pandemic outbreak the number of patients operated laparoscopically slightly but gradually increased, mostly due to the rise in laparoscopic cystectomies ( $p=0.050$ ). Contrary, the frequency of open surgeries for benign adnexal masses was declining especially when it comes to open salpingectomies ( $p=0.003$ ) (Table 1).

A substantial drop in the overall number of laparoscopic and open surgeries was clearly seen in the first year of pandemic ( $p=0.001$ ) (Figure 1). Moreover, the majority of surgeries were performed due to emergency condi-

tions (76.2%;  $p=0.001$ ). Nevertheless, this decrease was significant only for performed laparoscopic cystectomies ( $p=0.001$ ), but not for the rate of laparoscopic adnexectomies ( $p=0.224$ ) and salpingectomies ( $p=0.762$ ) (Figure 2). Moreover, the 2020 reduction in the frequency of open cystectomies ( $p=0.073$ ), adnexectomies ( $p=0.836$ ) and salpingectomies ( $p=0.241$ ) was also not significant. During the second year of the pandemic, the overall number of surgical procedures for benign adnexal masses started to rise again ( $p=0.023$ ) (Table 1).

Only two emergency surgeries of benign adnexal masses were performed in COVID-19 positive women, both executed using the open approach. No other patients developed symptoms or had a positive COVID-19 test during their stay in hospital, regardless of surgical approach or the type of surgery. Postoperative period was uneventful in all examined patients. Patients were discharged from the clinic on average on the 1.3 +/- 0.8 postoperative day after a laparoscopic surgery and on the 5.7 +/- 0.4 day after an open surgery for benign adnexal masses ( $p=0.001$ ).

Figure 2. Types of laparoscopic surgeries and open surgeries per year

## DISCUSSION

Surgery is a treatment of choice for numerous gynecological disorders, including benign and malignant uterine and adnexal pathologies. Since the beginning of the COVID-19 pandemic changes in the clinical routine and policies have posed certain issues concerning gynecological surgical treatment. Management of COVID-19 patients led to the redeployment of staff and resources causing a significant reduction in the total number of surgeries in many hospitals around the world, which was mostly reflected in elective non-emergency procedures, vaginal and minimally invasive gynecological surgery (9). In this unusual situation of crisis gynecologists were compelled to make a balance between patient treatment and prevention of COVID-19 infection, both for the patients and the staff. They strictly had to decide if a patient's situation needed urgent intervention and if so what would be the best treatment option and a surgical approach (laparoscopy or laparotomy) (10).

Surgical treatment of gynecologic conditions in COVID-19 pandemic was influenced by published recommendations for modifications of daily clinical practice issued by professional societies (11). At the beginning of pandemic different professional associations, including gynecological ones, released the Joint Statement saying that elective surgeries for benign conditions should be postponed, and if possible, alternate medical treatments should be considered, while in cases of malignancy or urgent conditions surgical treatment must not be delayed, but should be undertaken with precaution and using

all preventive measures against COVID-19. A surgical treatment of COVID-19 positive patients who do not require emergency surgery due to life-threatening conditions should be postponed until full recovery while implementing all possible alternative treatments along with treatment against COVID-19. The decision of the surgical approach (laparoscopy, mini laparotomy or laparotomy) should be individualized and based on available conditions for a safe procedure as well as classic medical indications (4, 5).

When the same time periods before and after pandemic onset were compared in different centers a decrease in the volume of elective and emergency surgical procedures ranged from 26% up to 87% (12, 13). This decrease was most obvious in case of elective surgeries, while the frequency of emergency procedures was even increased in some institutions (14). Moreover, authors assessing surgical treatment of abdominal pathologies observed significantly higher patient morbidity and mortality during COVID-19 pandemic causing an increase in admissions to the intensive care unit for the patients of similar age (12, 14). When gynecological and obstetrical services during pandemic were assessed a sharp negative trend was observed mostly during spring 2020, while surgical rates recovered to pre-pandemic levels by the end of 2020 (12, 13).

Laparoscopy generally has numerous benefits for patients such as shorter recovery time and hospital stay, a lower risk of post-surgical complications, a reduced risk of pain and consequently the use of pain medication, less bleeding and risk of hemorrhage during the operation (15). Therefore, minimally invasive surgical procedures are generally indicated when it comes to surgery of benign adnexal pathologies except in case of suspicious ovarian malignancy, the presence of large tumors in the pelvis or findings on adnexal regions larger than 10 cm in diameter (16). However, at the beginning of the pandemic concerns were made regarding the safety of laparoscopy. COVID-19 virus (SARS-CoV-2) is a respiratory agent transmitted by respiratory droplets. Laparoscopic surgery is based on pneumoperitoneum formation by inflating the abdominal compartment with CO<sub>2</sub>. That means that laparoscopic surgeries are aerosol-generating procedures during which it might be possible to aerosolize viral particles and contaminate the operating room (17). Therefore, laparoscopic surgery might pose a greater risk of virus exposure which can occur during intubation and extubation, during CO<sub>2</sub> inflating and expulsion as well as through surgical smoke of electrosurgical and ultrasonic devices which could all lead to aerosol induced infection. This concern was made because previous studies demonstrated increased transmission of other respiratory pathogens during laparoscopic surgeries. However, to date, no concrete evidence was found to prove that respiratory viruses are transmitted through electrosurgical smoke or aerosolized gas (18, 19). For that reason,

the finding of different microbial infections so far was not considered to be an absolute contraindication for the use of the laparoscopic approach, although specific protective measures are always recommended to avoid possible exposure to viral particles. Consequently, it was supposed that if similar protective measures are used in case of COVID-19 infection laparoscopic surgery could be safely performed (15, 20). Studies performed during the past two years have confirmed that with adequate preventive and protective measures laparoscopic surgery is possible without a significant increase in health risks for either patients or healthcare workers. Finally, different associations of endoscopic surgeons including gynecological ones proclaimed that laparoscopic approach should be undertaken whenever possible in preference to laparotomy in accordance with the current measures for safety of surgeons and patients (4, 5). One more reason for such recommendation is another benefit of laparoscopy presented in better use of hospital resources which is especially practical during the time of pandemic. Still, it is suggested to minimize the use of electrosurgical procedures, especially laser tissue ablation, ultrasonic scalpels, monopolar and advanced bipolar devices (21, 22). High-efficiency particulate air (HEPA) filters, ultra-low particulate air (ULPA) filters and closed smoke evacuation filtering devices are recommended if available to protect the medical staff against all potential risks of COVID-19 transmission. Moreover, some authors believe that if the patient is so urgent that there is not enough time for COVID-19 testing, laparotomy should be performed to prevent all risks (15, 23).

In recent years in our institution as well as worldwide, operations on the fallopian tubes are mostly performed laparoscopically. The number of laparoscopic fallopian tube operations remained similar during the analyzed period. On the other hand, the number of laparotomy operations was on the decline, but not significantly. Analyzing the number of operations of simple benign ovarian cysts in our clinic, it was obvious that in the period before the pandemic outbreak, the largest number of them was performed laparoscopically, while during the past two years there has been a significant decrease in the number of laparoscopic cystectomies. Unlike tubal surgery and ovarian cystectomy, removal of the ovaries with or without the fallopian tubes in our clinic was generally more often performed by laparotomy. The pandemic did not significantly impact either the overall number of performed adnexectomies or the approach used for these procedures.

Currently most institutions recommend that at admission all patients requiring urgent surgery should be questioned for having contacts with COVID-19 positive people over the past 14 days, screened for signs and symptoms of infection and also tested (quick antigen test) for COVID-19 infection (18, 24).

Our clinic has incorporated all current recommendations for COVID-19 prevention. According to the pro-

cedure of our Clinic all patients had to be pre-operatively tested for COVID-19 using a PCR test. Patients admitted for elective surgery (laparoscopic and open) are obligated to take a test 24 to 72 hours prior to the scheduled surgery and present a negative finding at admission to the clinic. In case of a positive finding, surgery is postponed until full recovery. On the other hand, emergency patients are all tested during the admission process. In case of positive test all precautions are taken (isolation from other patients, use of personal protective equipment of personnel, etc.) to prevent spreading the virus. If during their stay in hospital a patient shows signs and symptoms of COVID-19 she is immediately isolated, PCR tested and treated according to the current guidelines.

The strength and novelty of our study was the fact that it for the first time quantified the influence of COVID-19 pandemic on the performance of surgeries for benign adnexal conditions. Moreover, by examining a prolonged period of time we confirmed the safety of laparoscopic surgery even during the time of viral pandemic. However, the study limitation might be concentrating only on surgery of adnexal benign adnexal masses out of all different gynecological pathologies that are treated surgically. Still, according to clinical experience we hypothesized that the impact of reduced number of surgeries especially laparoscopic ones would have the most impact on adnexal pathologies and therefore they were chosen for investigation.

## CONCLUSION

Following the recommendations of relevant surgical societies and due to the need for moving and redeployment of doctors and nurses, COVID-19 pandemic was proven to have a significant negative impact on the number of laparoscopic cystectomies in our hospital, while the number of laparoscopic salpingectomies and adnexectomies slightly decreased. Open surgeries were reduced in the first pandemic year, but not significantly, as most of such procedures were performed due to emergency conditions. During the second year of the pandemic, the overall number of surgeries recovered. Finally, our findings of no registered intra-hospital COVID-19 infections throughout the two-year period showed that with adequate preventive and protective measures, minimally invasive approach for surgery was possible and did not significantly compromise health of either patients or medical professionals.

**Author Contributions:** MD was in charge of the concept or design of the work. BM, JD, TD and LA performed the acquisition, analysis, and interpretation of data. MD, BM and JD wrote the draft of the manuscript. All authors revised the final version of manuscript.

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## IMPLIKACIJE PANDEMIJE KOVIDA 19 NA LAPAROSKOPSKU I ABDOMINALNU HIRURGIJU BENIGNIH ADNEKSALNIH STANJA – ISKUSTVO JEDNOG CENTRA

Milan Dokić<sup>1</sup>, Branislav Milošević<sup>1,2</sup>, Jelena Dotlić<sup>1,2</sup>, Teodora Đerić<sup>1</sup>, Luka Andrić<sup>1</sup>, Sandra Babić<sup>1</sup>, Dragiša Šljivančanin<sup>1,2</sup>

### Sažetak

**Uvod/Cilj:** Pandemija Kovida19 predstavljala je izazov u lečenju pacijenata i izazvala je probleme u organizaciji zdravstvenih sistema u mnogim zemljama. Studija je imala za cilj da analizira i kvantifikuje uticaj pandemije Kovida19 na izvođenje operacija benignih adneksalnih stanja klasičnim (otvorenim abdominalnim) i minimalno invazivnim (laparoskopskim) pristupom na Klinici za ginekologiju i akušerstvo Univerzitetskog kliničkog centra Srbije.

**Materijal i metode:** U studiji su retrospektivno analizirane sve pacijentkinje koje su operisane zbog benignih adneksalnih masa na našoj Klinici u poslednjih pet godina. Uporedili smo brojeve i vrste operacija pre i tokom pandemije.

**Rezultati:** Studija je obuhvatila 2166 pacijentkinja koje su značajno češće imale laparoskopsku (61,9%) nego otvorenu operaciju (38,1%). Operacija benignih adneksalnih masa bila je elektivna u 53,2% slučajeva, a hitna

u 46,8% slučajeva. Pre pandemije, laparoskopske operacije (uglavnom cistektomije) bile su u porastu. U 2020. godini zabeleženo je smanjenje broja laparoskopskih i otvorenih operacija ( $p=0,001$ ). Štaviše, većina operacija je bila hitna (76,2%;  $p=0,001$ ). Ipak, ovo smanjenje je bilo značajno samo za laparoskopske cistektomije ( $p=0,001$ ), ali ne i za adneksektomije ( $p=0,224$ ) i salpingektomije ( $p=0,762$ ). Isto tako, smanjenje broja otvorenih cistektomija ( $p=0,073$ ), adneksektomija ( $p=0,836$ ) i salpingektomija ( $p=0,241$ ) u 2020. godini takođe nije bilo značajno. Tokom 2021. godine ponovo je počeo da raste broj hirurških zahvata u slučaju benignih adneksalnih masa ( $p=0,023$ ). Nisu registrovane intrahospitalne infekcije Kovidom 19.

**Zaključak:** Ukupan broj operacija benignih adneksalnih masa u našoj Klinici se smanjio i prilagodio samo hitnim stanjima, što se najviše odrazilo na minimalno invazivnu hirurgiju.

**Ključne reči:** Kovid 19, ginekološka hirurgija, patologija adneksa, laparoskopija, laparotomija

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