






# A propensity score-matched retrospective cohort study of hysterectomies for benign disease during the COVID-19 pandemic

Isabella Barcellos Leite<sup>1</sup> , Nino Jose Wilson Moterani Junior<sup>2,3\*</sup> , Vinicius Cesar Moterani<sup>2</sup> ,  
Laura Bresciani Bento Gonçalves Moterani<sup>2</sup> , Francisco José Candido dos Reis<sup>3</sup> 

## SUMMARY

**OBJECTIVE:** This study aimed to evaluate how the pandemic might have affected the number of elective and urgent hysterectomies for benign gynecological pathologies in a single-care tertiary center in the State of São Paulo, Brazil, and to identify if there were any changes in the need for blood transfusions.

**METHODS:** This is a single-center retrospective cohort study. It involved all non-puerperal and non-oncological hysterectomies from October 2018 to July 2021. Patients were divided into two groups, namely, the pandemic group (46 patients) and the control group (92 patients). Data were collected by reviewing the physical and electronic patient records. We carried out the statistical analysis using the RStudio software.

**RESULTS:** The number of planned hysterectomies was 82 in the pre-pandemic group and 23 in the analysis group, representing a 71.9% decrease. When considering only urgent surgeries, 10 of them happened in the pre-pandemic group, while 23 occurred in the pandemic group, representing an increase of 130%.

**CONCLUSION:** Elective hysterectomies may improve the quality of life of women, reducing abnormal bleeding and pelvic pain. Treatment delay can worsen patients' physiological and biological conditions, such as lower labor production, humor, and social aspects, increasing costs to the healthcare system.

**KEYWORDS:** COVID-19. Hysterectomy. Pandemics. Gynecologic surgical procedures.

## INTRODUCTION

The coronavirus disease (COVID-19) pandemic started on May 2019 in the city of Wuhan, Hubei Province, China<sup>1</sup>. In Brazil, the first case was reported in March 2020 in the city of São Paulo<sup>2</sup>. Governments, fearing a collapse of health systems, started social distancing policies. Healthcare facilities had to postpone outpatient appointments and elective surgeries in order to prioritize resources to treat patients with acute respiratory syndrome (ACR) caused by the novel coronavirus (SARS-CoV-2)<sup>3-7</sup>.

Among the postponed surgeries, hysterectomies are included. This procedure is widely used to treat several gynecological diseases, most coursing with abnormal uterine bleeding, and may be performed by different access points, such as vaginal, laparotomy, or laparoscopy<sup>7,8</sup>.

The number of deaths and people directly affected by the COVID-19 pandemic worldwide has been widely investigated. However, the full burden of the outbreak remains unknown, especially regarding changes in the treatment of other diseases<sup>9,10</sup>.

The goal of this study was to evaluate how the pandemic might have affected the number of elective and urgent hysterectomies for benign gynecological pathologies in a single-care tertiary center in the State of São Paulo, Brazil, and to identify if there were any changes in the need for blood transfusions.

## METHODS

We performed a single-center retrospective cohort study. We included all non-puerperal hysterectomies performed from October 2018 up to July 2021. From March 2020 to July 2021, our Outpatient Clinic of Gynecology was closed as a restrictive measure due to the COVID-19 pandemic. Therefore, patients who needed immediate medical care had to seek our emergency department. Thus, we divided patients into two groups: the pre-pandemic group contains patients who underwent hysterectomy from October 2018 to February 2020 and the pandemic group represents patients who had their surgeries performed from March 2020 to July 2021. Thus, both groups spanned

<sup>1</sup>Faculdade de Medicina de Marília – Marília (SP), Brazil.

<sup>2</sup>Faculdade de Medicina de Marília, Department of Gynecology and Obstetrics – Marília (SP), Brazil.

<sup>3</sup>Universidade de São Paulo, Ribeirão Preto Medical School, Department of Gynecology and Obstetrics – Ribeirão Preto (SP), Brazil.

\*Corresponding author: [nino.mt@gmail.com](mailto:nino.mt@gmail.com)

Conflicts of interest: the authors declare there is no conflicts of interest. Funding: none.

Received on November 27, 2022. Accepted on December 15, 2022.

a period of 17 months. Exclusion criteria were patients with planned oncological hysterectomies and missing data.

Our main hypothesis is that patients having surgery during the pandemic period had different pre-surgical hemoglobin levels and required different amounts of blood transfusions when compared to patients in the control group. Furthermore, we also analyzed the proportion of elective and urgent surgeries during each period.

Data were collected by reviewing physical and electronic patient records. All data were collected by one of the researchers, and it was checked for inconsistencies by two other different researchers. In case of inconsistencies, patient records were reviewed again.

For each patient, we recorded information regarding ethnicity, education level, marital status, type of surgery (elective or urgent), surgical operative time in hours, hemoglobin level before surgery, and volume of blood transfusion before, during, and after the surgery, if any. Blood transfusion was included when occurring 30 days before or after the surgery.

Since there were more patients in the group whose surgery happened before the pandemic, we used propensity score matching with a ratio of 2 controls per 1 case to compare both groups. Equal variables for matching were ethnicity, marital status, educational level, type of surgery, and surgery length<sup>11</sup>. Nominal variables were adjusted for this method. The race was adjusted to a binary variable, as either white or non-white ethnicity, since the majority of patients belonged to this group. Marital status was also converted into a binary variable, either in a relationship with a partner or without a relationship. Education was maintained as an ordinal variable with seven degrees, namely, no education, incomplete primary grade, complete primary grade, incomplete high school education, complete high school education, incomplete college education, or complete college education. We used a linear regression model to test the correlation between the amount of blood transfusion required and the aforementioned variables. The same procedure was carried out for pre-surgical hemoglobin levels and the study variables. This process was repeated for an exploratory subgroup analysis among all urgent surgery patients in the study. Finally, the number of planned and urgent surgeries in both groups of the total cohort was compared with the exact Poisson test, with the period of 17 months being equal in both groups. We carried out the statistical analysis using the RStudio version 4.1.1 software (dated 2021-08-10).

This research follows the STROBE guideline. The study began after ethical approval by the local research ethics committee (CAAE 51821921.8.0000.5413). We followed the Declaration of Helsinki.

## RESULTS

Initially, we included 262 patients. Following exclusion criteria, we removed 81 patients who were planned oncological surgeries. One patient was excluded due to missing data. Of the 180 patients included, 46 patients underwent surgeries during the pandemic, which were matched to 92 controls, for a total of 138 patients analyzed in this research.

The number of planned hysterectomies was 82 in the pre-pandemic group and 23 in the analysis group, representing a 71.9% decrease. The exact Poisson test is statistically significant in this analysis, with a p-value <0.01. When considering only urgent surgeries, 10 happened in the pre-pandemic group, while 23 occurred in the pandemic group, representing an increase of 130%. The Poisson exact test for the number of urgent surgeries demonstrated a higher-than-expected value during the outbreak, and the p-value was 0.03.

Linear regression models applied to the matched cohort identified a statistically significant association between the amount of blood transfusion and both surgery type (p<0.01) and surgery length (p<0.01). Pre-surgical hemoglobin values in the linear regression model were correlated exclusively to surgery type (p<0.01). In both cases, surgery before or during the COVID-19 pandemic as an individual variable was not associated with the amount of blood transfusion required or pre-surgical hemoglobin. This group is presented in Table 1.

Analysis continued in the urgency hysterectomy group, which had a total of 33 patients. In the linear regression model, no variable was found to be associated with either the amount of blood transfusion required or the pre-surgical hemoglobin levels. Characteristics of this subgroup are summarized in Table 2.

## DISCUSSION

There was a reduction in the number of surgeries performed during the pandemic period. This finding is probably related to health policies to prioritize resources to deal with the pandemic, such as operating rooms, individual protection equipment, and medications. On the contrary, an increase in urgent surgeries was found, as well as a positive association between urgent surgeries and lower pre-surgical hemoglobin values and the amount of blood transfusion required. Moreover, there was a delay in outpatient clinic appointments and elective surgeries to avoid a collapse of the healthcare system<sup>12-16</sup>.

Our findings are similar to a study that evaluated the total number of gynecological procedures performed in 2019 and 2020, due to benign and malignant pathologies, in a large teaching hospital system. In that study, a reduction of 75% in the number of surgeries performed was found as a consequence of

the delay of elective surgeries<sup>3</sup>. Another study evaluated hospital admission in 18 teaching hospitals in Germany, and comparing 2018 to 2020, hysterectomies due to benign conditions suffered a reduction of 78.8%<sup>4</sup>.

Although we observed a reduction in hysterectomies, we also found an increase of 130% in the number of urgent hysterectomies during the pandemic. Moreover, urgent surgeries were associated with the necessity of blood transfusion and lower pre-surgical hemoglobin values. Therefore, it is possible that the delay in appointments and surgeries worsened the gynecological condition that demanded a hysterectomy<sup>17</sup>.

It is important to note that if, on the one hand, the delay of appointments and surgeries probably helped dealing with the pandemic, on the other hand, other conditions were neglected. The increase in the need for blood transfusions, in a scenario

of a global decrease in blood donations, shows us that health policies must consider several variables<sup>18,19</sup>.

As the strengths of this study, we point out that we collected data from a large number of uniform patient electronic records. As limitations, our findings represent the reality of the region assisted by our service and may not represent what was observed in our state or country.

## CONCLUSION

Elective hysterectomies may improve the quality of life of women, reducing abnormal bleeding and pelvic pain. Treatment delay can worsen patients' physiological and biological conditions, such as lower labor production, humor, and social aspects, increasing costs to the healthcare system<sup>3,4,20</sup>.

**Table 1.** Characteristics of a cohort of patients submitted to hysterectomy before and during the COVID-19 pandemic.

	Pandemic (n=46)	Pre-pandemic (n=92)	Overall (n=138)
Ethnicity			
Non-white	15 (32.6%)	22 (23.9%)	37 (26.8%)
White	31 (67.4%)	70 (76.1%)	101 (73.2%)
Marital status			
No relationship with partner	16 (34.8%)	29 (31.5%)	45 (32.6%)
Relationship with partner	30 (65.2%)	63 (68.5%)	93 (67.4%)
Education level			
No education	0 (0%)	2 (2.2%)	2 (1.4%)
Incomplete primary grade	20 (43.5%)	42 (45.7%)	62 (44.9%)
Complete primary grade	12 (26.1%)	14 (15.2%)	26 (18.8%)
Incomplete high school	1 (2.2%)	5 (5.4%)	6 (4.3%)
Complete high school	9 (19.6%)	20 (21.7%)	29 (21.0%)
Incomplete college education	1 (2.2%)	2 (2.2%)	3 (2.2%)
Complete college education	3 (6.5%)	7 (7.6%)	10 (7.2%)
Surgery length			
Mean (SD)	3.03 (0.883)	2.85 (1.04)	2.91 (0.989)
Median [min, max]	2.75 [1.67, 5.50]	2.75 [1.00, 6.58]	2.75 [1.00, 6.58]
Surgery type			
Planned	23 (50.0%)	82 (89.1%)	105 (76.1%)
Urgent	23 (50.0%)	10 (10.9%)	33 (23.9%)
Pre-surgical hemoglobin			
Mean (SD)	10.8 (3.15)	12.8 (2.29)	12.2 (2.78)
Median [min, max]	11.2 [4.90, 16.5]	13.2 [5.90, 23.7]	12.6 [4.90, 23.7]
Blood bags used			
Mean (SD)	1.39 (2.21)	0.348 (1.35)	0.696 (1.75)
Median [min, max]	0 [0, 9.00]	0 [0, 10.0]	0 [0, 10.0]

**Table 2.** Characteristics of a subgroup of patients submitted to urgent hysterectomy before and during the COVID-19 pandemic.

	Pandemic (n=23)	Pre-pandemic (n=10)	Overall (n=33)
Ethnicity			
Non-white	7 (30.4%)	4 (40.0%)	11 (33.3%)
White	16 (69.6%)	6 (60.0%)	22 (66.7%)
Marital status			
No relationship with partner	9 (39.1%)	2 (20.0%)	11 (33.3%)
Relationship with partner	14 (60.9%)	8 (80.0%)	22 (66.7%)
Education level			
No education	0 (0%)	2 (20.0%)	2 (6.1%)
Incomplete primary grade	11 (47.8%)	4 (40.0%)	15 (45.5%)
Complete primary grade	5 (21.7%)	1 (10.0%)	6 (18.2%)
Incomplete high school	0 (0%)	0 (0%)	0 (0%)
Complete high school	5 (21.7%)	3 (30.0%)	8 (24.2%)
Incomplete college education	1 (4.3%)	0 (0%)	1 (3.0%)
Complete college education	1 (4.3%)	0 (0%)	1 (3.0%)
Surgery length			
Mean (SD)	3.02 (0.844)	3.88 (1.30)	3.28 (1.06)
Median [min, max]	2.75 [2.25, 5.50]	3.54 [2.50, 6.17]	2.83 [2.25, 6.17]
Pre-surgical hemoglobin			
Mean (SD)	8.73 (2.64)	10.4 (3.05)	9.24 (2.83)
Median [min, max]	8.40 [4.90, 14.2]	11.6 [5.90, 14.1]	8.90 [4.90, 14.2]
<b>Blood bags used</b>			
Mean (SD)	2.57 (2.59)	2.60 (3.31)	2.58 (2.77)
Median [min, max]	2.00 [0, 9.00]	1.50 [0, 10.0]	2.00 [0, 10.0]

## AUTHORS' CONTRIBUTIONS

**IBL:** Data curation, Formal Analysis, Investigation, Visualization, Writing – original draft, Writing – review & editing. **NJWMJ:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. **VCM:**

Data curation, Formal Analysis, Investigation, Methodology, Supervision, Visualization, Writing – original draft, Writing – review & editing. **LBBGM:** Formal Analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **FJCR:** Methodology, Writing – original draft, Writing – review & editing.

## REFERENCES

- Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19). *Int J Surg*. 2020;76:71-6. <https://doi.org/10.1016/j.ijsu.2020.02.034>
- Oliveira RDP, Santos MCL, Moreira CB, Fernandes AFC. Detection of breast cancer: knowledge, attitude, and practice of family health strategy women. *J Canc Educ*. 2018;33(5):1082-7. <https://doi.org/10.1007/s13187-017-1209-4>
- Gupta S, Maghsoudlou P, Ajao M, Ivar Einarsson J, Perkins King L. Analysis of COVID-19 response and impact on gynecologic surgery at a large academic hospital system. *JLS*. 2021;25(4):e2021.00056. <https://doi.org/10.4293/JLS.2021.00056>
- Kapsner LA, Kampf MO, Seuchter SA, Gruendner J, Gulden C, Mate S, et al. Reduced rate of inpatient hospital admissions in 18 German university hospitals during the COVID-19 lockdown. *Front Public Health*. 2021;8:594117. <https://doi.org/10.3389/fpubh.2020.594117>

5. Shehata IM, Elhassan A, Jung JW, Urits I, Viswanath O, Kaye AD. Elective cardiac surgery during the COVID-19 pandemic: proceed or postpone? *Best Pract Res Clin Anaesthesiol.* 2020;34(3):643-50. <https://doi.org/10.1016/j.bpa.2020.07.005>
6. Gilat R, Haunschild ED, Tauro T, Cole BJ. Recommendations to Optimize the Safety of Elective Surgical Care While Limiting the Spread of COVID-19: Primum Non Nocere. *Arthrosc Sports Med Rehabil.* 2020;2(3):e177-83. <https://doi.org/10.1016/j.asmr.2020.04.008>
7. Chrysostomou A, Chrysostomou M. COVID-19 pandemic: which hysterectomy? 2020;2(1):4.
8. Kaye K, Paprottka F, Escudero R, Casabona G, Montes J, Fakin R, et al. Elective, Non-urgent procedures and aesthetic surgery in the wake of SARS-COVID-19: considerations regarding safety, feasibility and impact on clinical management. *Aesthetic Plast Surg.* 2020;44(3):1014-42. <https://doi.org/10.1007/s00266-020-01752-9>
9. Leandro PHF. Escola de Saúde Pública Do Ceará Hospital Geral de Fortaleza Programa De Residência Médica Em Urologia. 2021;20.
10. Mendes FF. COVID-19 e a retomada das cirurgias eletivas. Como voltaremos à normalidade? *Braz J Anesthesiol.* 2020;70(5):455-6. <https://doi.org/10.1016/j.bjan.2020.09.001>
11. Miguel L, Silva JCRE, Poli Neto OB, Tiezzi DG, Andrade JM, Reis FJCD. A propensity score-matched case-control study of laparoscopy and laparotomy for endometrial cancer. *Rev Assoc Med Bras.* 2021;67(5):753-8. <https://doi.org/10.1590/1806-9282.20210194>
12. Iacobucci G. Covid-19: all non-urgent elective surgery is suspended for at least three months in England. *BMJ.* 2020:m1106. <https://doi.org/10.1136/bmj.m1106>
13. Metelmann IB, Busemann A. Elective surgery in times of COVID-19: a two-centre analysis of postponed operations and disease-related morbidity and mortality. *Z Evid Fortbild Qual Gesundheitswes.* 2020;158-9:62-5. <https://doi.org/10.1016/j.zefq.2020.10.003>
14. Almeida ALC, Santo TM do E, Mello MSS, Cedro AV, Lopes NL, Ribeiro APMR, et al. Repercussões da Pandemia de COVID-19 na Prática Assistencial de um Hospital Terciário. *Arquivos Brasileiros de Cardiologia [Internet].* 17 de setembro de 2020 [citado 29 de outubro de 2022]; Disponível em: <http://abccardiol.org/en/article/repercussions-of-the-covid-19-pandemic-on-the-care-practices-of-a-tertiary-hospital/>
15. Gangbe E, Cai E, Penta R, Mansour FW, Krishnamurthy S. Effects of surgical delay due to COVID-19 on women requiring emergency gynaecological surgery. *J Obstet Gynaecol Can.* 2021;43(11):1296-300. <https://doi.org/10.1016/j.jogc.2021.05.016>
16. Rocco M, Oliveira BL, Rizzardi DAA, Rodrigues G, Oliveira G, Guerreiro MG, et al. Impact of the COVID-19 pandemic on elective and emergency surgical procedures in a University Hospital. *Rev Col Bras Cir.* 2022;49:e20223324. <https://doi.org/10.1590/0100-6991e-20223324-en>
17. Al-Jabir A, Kerwan A, Nicola M, Alsafi Z, Khan M, Sohrabi C, et al. Impact of the coronavirus (COVID-19) pandemic on surgical practice - Part 1. *Int J Surg.* 2020;79:168-79. <https://doi.org/10.1016/j.ijsu.2020.05.022>
18. Coutinho F, Nascimento C, Miranda L, Ramos M, Rodrigues A, Berg A. Impactos da pandemia de COVID-19 na doação de sangue no Brasil: análise histórica dos anos de 2011-2020. *Hematology, Transfusion and Cell Therapy.* outubro de 2021;43(1):S525. <https://doi.org/10.1016/j.htct.2021.10.907>
19. Magalhães N, Silva-Malta M, Chaves D, Ribeiro M, Cioffi J, Martins M, et al. Impacto da COVID-19 na rede hemoterápica: experiência da fundação hemominas. *Hematol Transfus Cell Ther.* 2021;43:S523. <https://doi.org/10.1016/j.htct.2021.10.903>
20. Nepogodiev D, Martin J, Biccard B, Makupe A, Bhangu A; National Institute for Health Research Global Health Research Unit on Global Surgery. Global burden of postoperative death. *The Lancet.* 2019;393(10170):401. [https://doi.org/10.1016/S0140-6736\(18\)33139-8](https://doi.org/10.1016/S0140-6736(18)33139-8)

