Analysis of COVID-19 Response and Impact on Gynecologic Surgery at a Large Academic Hospital System

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ABSTRACT

BACKGROUND AND OBJECTIVES: The COVID-19 pandemic dramatically impacted gynecologic surgery. In March 2020, the American College of Surgeons recommended delay of all nonessential invasive procedures. This study characterizes the number and types of procedures performed during the peak pandemic.

METHODS: A retrospective cohort study was performed. All patients undergoing gynecological surgery at a large academic hospital system from March 16, 2019 to July 31, 2019 and from March 16, 2020 to July 31, 2020 were evaluated. Data was stratified by three time periods corresponding to state and hospital policy changes. During period 1, no nonessential procedures were advised. During period 2, urgent procedures resumed. During period 3, full surgical reopening was achieved.

RESULTS: In 2019, 1,545 gynecologic cases were performed compared with 942 cases in 2020 (39.0% decrease). There was a 73.6% decrease in cases over period 1, a 20.1% decrease over period 2, and a 2.9% increase over period 3. Cases performed by gynecologic oncologists in 2020 accounted for 58.1% of all gynecologic cases over period 1, 29.4% of cases over period 2, and 33.3% of cases over period 3. In 2020, hysterectomy was the most commonly performed procedure, while surgery for endometriosis and uterine fibroids had the greatest decrease in volume. Among emergency procedures, more surgery for ectopic pregnancy was performed in 2020 compared with 2019.

CONCLUSION: Many patients had significant delays in receiving gynecologic surgical care during the peak pandemic period. Further studies are indicated to determine the impact of delayed care on patients’ quality of life and disease process.

Key Words: Essential gynecologic surgery, Pandemic response, Women’s health.

INTRODUCTION

The COVID-19 pandemic has dramatically impacted medical care. Hospitals encountered unprecedented challenges and created policies to conserve resources while ensuring safety. In March 2020, the American College of Surgeons (ACS) recommended delay of all nonessential invasive procedures.1 No delay was recommended for gynecologic emergencies including ectopic pregnancy, miscarriage, adnexal torsion, tubo-ovarian abscess, acute severe vaginal bleeding, and emergency cerclage. Additional surgeries in which delay could cause significant patient harm included surgery for cancer, history-indicated cerclage, and pregnancy termination.

On Sun March 15, 2020, an Executive Order was released to postpone or cancel nonessential, elective procedures. There was a significant decrease in surgeries performed between March 1, 2020 and July 31, 2020.2-5 From May 18th to June 23rd our institution proceeded through a staged reopening, and full reopening of surgical cases was achieved on June 24th.
Defining which procedures were urgent and which procedures could be appropriately delayed proved elusive. Our hospital followed the ACS guidelines with some decisions made on a case-by-case basis. In this study, we characterize the number and types of procedures performed during the peak pandemic period compared to the same time period in 2019. Moving forward, we believe this preliminary data can help inform us as we face additional challenges in addressing COVID-19 or future pandemics. Allocation of scarce resources during an emergency typically relies upon utilitarian principles with a goal of achieving the most good for the most people. Defining harm that results from these decisions is thus an important step in ethical analysis.

**METHODOLOGY**

We conducted a retrospective cohort study, identifying all gynecological surgical procedures performed at a large academic hospital system between March 16, 2020 and July 31, 2020, as well as cases during the same months of 2019. Local Institutional Review Board exemption was obtained for this study (IRB: 6/22/2020, Protocol #: 2020P001933). This information was obtained from an electronic medical record system search that gathers clinical information from various institutional hospital systems.

Data collected included date of procedure, patient age, body mass index (BMI), race, American Society of Anesthesiologists (ASA) Physical Status Classification, surgeon subspecialty, pre-operative diagnosis, and procedure performed. Data was stratified by time period corresponding to time points when national and hospital-wide policies changed. Period 1 included cases between March 16, 2020 and May 17, 2020, during which time the Executive Order placed a moratorium on all nonessential, elective procedures. Period 2 included cases between May 18, 2020 and June 23, 2020, during which time urgent, elective procedures were permitted to resume. Period 3 included cases between June 24, 2020 and July 31, 2020, during which time all nonessential, elective procedures were permitted to resume. Descriptive statistics were employed with comparisons made using $\chi^2$ test or the Fisher's exact test for categorical variables, and two-sided Student's $t$ test for continuous variables.

**RESULTS**

Demographics and baseline patient characteristics are summarized in Table 1. There was no difference in race, BMI, age, or ASA physical status in patients undergoing...
surgery between March 16, 2020 and July 31, 2020 compared to the same overall period in 2019. There was a drastic decrease in the total number of cases performed over our study period. In 2019, 1,545 gynecologic cases were performed. This number decreased to 942 cases in 2020 (39.0% decrease). Further evaluation of total gynecologic surgery case volume throughout each of the three time periods yielded the following results: from 2019 to 2020 there was a 73.6% decrease in cases over period 1, a 20.1% decrease over period 2, and a 2.9% increase over period 3 (Figure 1 and Table 2).

As a marker for overall hospital volume and corresponding control group, we examined the number of cesarean sections (c-sections) performed by Labor and Delivery at our institution. We did not expect a decrease in these numbers since obstetrical care was uninterrupted due to its nonelective and time-sensitive nature, as well as potential for fetomaternal morbidity and mortality with a delay in or complete absence of care.\(^6\)\(^7\) Over our study period, there were 717 c-sections performed in 2020, compared with 790 c-sections in 2019 (9.2% decline). Additionally, no significant decrease in c-section volume was found when stratified by period (Figure 2 and Table 7).

We also evaluated the types of procedures performed over our study period (Table 3). There were no major factors that should have contributed to change in the route of surgery performed, and laparoscopy continued to comprise approximately 50% of all gynecologic surgery cases.

As previously noted, there was a 73.6% decrease in total gynecologic case number from 2019 to 2020 during period 1. During this period, hysterectomy decreased by 60.5%, hysteroscopy decreased by 85.1%, dilation and curettage (D&C), and dilation and evacuation (D&E) decreased by 78.6%, myomectomy decreased by 81.0%, resection of endometriosis decreased by 90.4%, and cystectomy decreased by 84.9%. While the absolute number of hysterectomies decreased 60.5%, the proportion of hysterectomies increased from 29.1% of all gynecologic cases in 2019, to 43.5% of all gynecologic cases in 2020 over period 1. Most surgeries performed during period 1 were by gynecologic oncologists, reflecting appropriate standard of care for patients with confirmed or suspected malignancies. However, there was still almost a 50% decrease in the number of cases performed by gynecologic oncologists during this time. Tables 2, 4, and 5 demonstrate the number and types of cases performed when stratified by benign gynecologic surgeons and gynecologic oncologists.

In period 2, all gynecologic cases decreased by 20.1% from 2019 to 2020. Hysterectomy, hysteroscopy, D&C/D&E, and resection of endometriosis decreased by 39.0%, 53.3%, 38.6%, and 28.9%, respectively. Myomectomy increased by 2.5% and cystectomy increased by 35.3%. In period 3, total gynecologic cases increased by 2.9%. Hysterectomy decreased by 22.5% and resection of endometriosis decreased by 1.4%, while hysteroscopy, D&C/D&C, and myomectomy increased by 23.1%, 36.4%, and 29.4%, respectively (Table 3).

Gynecologic emergency procedures (generally requiring operation within 60 minutes of diagnosis and based on ACS...
guidelines) were evaluated by pre-operative diagnosis. Over our study period, surgery for ectopic pregnancy increased from 18 in 2019 to 25 in 2020 (38.9% increase). The number of surgeries for early pregnancy loss (missed abortion, incomplete abortion, retained products of conception) decreased from 46 in 2019 to 26 in 2020 (43.5% decrease). The number of surgeries for ovarian torsion went from 9 in 2019 to 7 in 2020. The number of emergency

Table 2.

|                  | Overall | Period 1 (March 16 - May 17) | Period 2 (May 18 - June 23) | Period 3 (June 24 - July 31) |
|------------------|---------|-----------------------------|-----------------------------|-----------------------------|
|                  | 2019    | 2020 | % change | 2019    | 2020 | % change | 2019    | 2020 | % change |
| All GYN          | 942     | 723  | −39.0%    | 191     | 413  | −73.6%    | 330     | 409  | −20.1%    |
| Benign GYN       | 1072    | 594  | −44.6%    | 512     | 80   | −84.4%    | 293     | 233  | −20.5%    |
| Oncology GYN     | (69.39%)| (63.06%) | (69.39%) | (63.06%) | (69.39%) | (63.06%) | (69.39%) | (63.06%) | (69.39%) |
| GYN Oncology     | 473     | 348  | −26.4%    | 211     | 111  | −47.4%    | 120     | 97   | −19.2%    |
| Oncology GYN     | (30.61%)| (36.94%) | (30.61%) | (36.94%) | (30.61%) | (36.94%) | (30.61%) | (36.94%) | (30.61%) |

Figure 2. Cesarean sections performed by labor and delivery by time period.

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liver transplantation procedures performed went from 4 in 2019 to 5 in 2020 (Table 6).

In 2019, 69.4% of all cases were performed by benign gynecologic surgeons and 30.61% were performed by gynecologic oncologists. In 2020, the proportion of cases performed by gynecologic oncologists increased to 36.9%. When stratified by period, cases performed by gynecologic oncologists in 2020 accounted for 58.1% of all gynecologic cases over period 1, 29.4% of cases over period 2, and 33.3% of cases over period 3 (Table 2).

**DISCUSSION/CONCLUSIONS**

The immediate response of the moratorium on elective cases resulted in almost a 75% decrease in gynecologic surgical volume. Peak COVID-19 census at our institution was April 26, 2020. A major limitation to reopening was the redeployment of operating room staff (nursing, surgical technicians, anesthesia) to other hospital units to assist in COVID-19 efforts. The observed decrease in gynecologic surgery volume persisted for months, until a small increase was seen in July 2020.

Hysterectomy continued to be the most commonly performed gynecologic procedure over our study period. Many benign gynecologic surgeries were disproportionately delayed during period 1. Surgery for endometriosis and fibroids were especially affected, with overall numbers decreasing by 90.4% and 81.0%, respectively. These gynecologic procedures, while classified as nonurgent and elective, are procedures that significantly improve quality of life and can alleviate burden of disease including infertility, pelvic pain, and debilitating vaginal bleeding. Further studies are needed to assess the impact of delayed surgery on patients' physical and psychological wellbeing. Anecdotally, we have seen the adverse effects of delayed surgery for fibroids and endometriosis on our patients, including the need for interval emergency department visits and inpatient admissions.

Period 2 experienced only a 20.1% decline in overall gynecologic surgery and a 20.5% decline among benign gynecologic surgeons. This suggests that a significant portion of gynecologic surgical care may be performed on an emergent or urgent basis. We then saw a rise in the overall number of cases in period 3. This may reflect efforts on the healthcare system in attempts to catch up on cases that were delayed in earlier periods so that patients are able to receive needed care.

We examined surgical emergencies by diagnosis and hypothesized there would be little change in the number of procedures performed despite the new regulations, as surgical

### Table 3.

| Overall                     | Period 1 (March 16 - May 17) | Period 2 (May 18 - June 23) | Period 3 (June 24 - July 31) |
|-----------------------------|------------------------------|-----------------------------|------------------------------|
|                             | 2019 (n = 1545)             | 2020 (n = 1911)             | 2019 (n = 413)               | 2020 (n = 330)               | 2019 (n = 409)             | 2020 (n = 421)             | % change |
| Hysterectomy                | 502 (32.5%)                 | 210 (29.1%)                 | 141 (34.1%)                  | 151 (36.9%)                  | 117 (27.8%)                | -22.5%                  |
| Hysteroscopy                | 410 (26.5%)                 | 208 (28.8%)                 | 111 (26.9%)                  | 74 (22.4%)                   | 91 (22.3%)                 | 23.1%                   |
| D&C/D&E**                  | 270 (17.5%)                 | 145 (20.1%)                 | 70 (17.0%)                   | 43 (13.0%)                   | 55 (13.5%)                 | 36.4%                   |
| Myomectomy                 | 137 (8.9%)                  | 63 (8.7%)                   | 40 (9.7%)                    | 41 (12.4%)                   | 34 (8.3%)                  | 29.4%                   |
| Endometriosis              | 141 (9.1%)                  | 52 (7.2%)                   | 45 (10.9%)                   | 32 (9.7%)                    | 44 (10.8%)                 | -2.3%                   |
| Laparoscopy                 | 764 (49.5%)                 | 336 (46.5%)                 | 210 (50.9%)                  | 170 (51.5%)                  | 218 (53.3%)                | -1.4%                   |
| Cystectomy                 | 64 (4.1%)                   | 33 (4.6%)                   | 17 (4.1%)                    | 23 (7.0%)                    | 14 (3.4%)                  | 22 (5.2%)                | 57.1%                   |

*Percentages in each column do not add up to 100% since some cases included multiple listed procedures. Percentages in parentheses refer to proportion of total cases as indicated by the n-value in each corresponding column header.

**These numbers represent cases performed in the gynecology operating rooms and do not include additional procedures performed on the Labor & Delivery floor.
Emergencies require prompt identification and treatment. However, we noted a 38.9% rise in the number of ectopic pregnancies treated surgically. It is not clear why surgery for ectopic pregnancy increased. A recent study from Italy noted a similar increase in ruptured ectopic pregnancy during the pandemic.8 It is possible that patients opted to delay care and thus presented later when more conservative treatment was contraindicated. Alternatively, it is possible that surgeons and patients were uncomfortable managing ectopic pregnancies as outpatients, with uncertainty surrounding safety of or feasibility in obtaining serial labs. Finally, it is possible that there were more early pregnancies as a result of stay-at-home orders, and thus more ectopic pregnancies. Further study is warranted to explore the significance and causes of this increase in surgical management of ectopic pregnancy.

**Table 4.**
Gynecologic Procedures Performed by Benign Gynecologists by Period

| Procedure      | Overall 2019 (n = 1072) | Overall 2020 (n = 594) | % change | Period 1 (March 16 - May 17) 2019 (n = 512) | Period 1 (March 16 - May 17) 2020 (n = 80) | % change | Period 2 (May 18 - June 23) 2019 (n = 293) | Period 2 (May 18 - June 23) 2020 (n = 233) | % change | Period 3 (June 24 - July 31) 2019 (n = 267) | Period 3 (June 24 - July 31) 2020 (n = 281) | % change |
|----------------|-------------------------|------------------------|----------|------------------------------------------|------------------------------------------|----------|------------------------------------------|------------------------------------------|----------|------------------------------------------|------------------------------------------|----------|
| Hysterectomy   | 240 (22.4%)             | 97 (16.3%)             | −59.6%   | 95 (18.6%)                               | 9 (11.3%)                                | −90.5%   | 74 (25.3%)                               | 39 (16.7%)                               | −47.3%   | 71 (26.6%)                               | 49 (17.4%)                               | −31.0%   |
| Hysteroscopy   | 377 (35.2%)             | 193 (32.5%)            | −48.8%   | 194 (37.9%)                              | 28 (35.0%)                               | −85.6%   | 102 (34.8%)                              | 67 (28.8%)                               | −34.3%   | 81 (30.3%)                               | 98 (34.9%)                               | 21.0%    |
| D&C/D&E**      | 231 (21.0%)             | 122 (20.5%)            | −47.2%   | 127 (24.8%)                              | 28 (35.0%)                               | −78.0%   | 60 (20.5%)                               | 35 (15.0%)                               | −41.7%   | 44 (16.5%)                               | 59 (21.0%)                               | 34.1%    |
| Myomectomy     | 136 (12.7%)             | 63 (12.3%)             | −54.7%   | 63 (12.3%)                               | 12 (15.0%)                               | −81.0%   | 40 (13.7%)                               | 41 (17.6%)                               | 2.5%     | 33 (12.4%)                               | 44 (15.7%)                               | 33.3%    |
| Endometriosis  | 141 (13.2%)             | 52 (10.2%)             | −64.0%   | 52 (10.2%)                               | 4 (5.0%)                                 | −92.3%   | 45 (15.4%)                               | 32 (13.7%)                               | −28.9%   | 44 (16.5%)                               | 43 (15.3%)                               | −2.3%    |
| Laparoscopy    | 488 (45.5%)             | 275 (46.3%)            | −43.6%   | 212 (41.4%)                              | 29 (36.3%)                               | −86.3%   | 136 (46.4%)                              | 110 (47.2%)                              | −19.1%   | 140 (52.4%)                              | 136 (48.4%)                               | −2.9%    |
| Cystectomy     | 62 (5.8%)               | 45 (7.6%)              | −27.4%   | 32 (6.3%)                                | 3 (3.8%)                                 | −90.6%   | 16 (5.5%)                                | 21 (9.0%)                                | 31.3%    | 14 (5.2%)                                | 21 (7.5%)                                | 50.0%    |

*Percentages in each column do not add up to 100% since some cases included multiple listed procedures. Percentages in parentheses refer to proportion of total cases as indicated by the n-value in each corresponding column header.

**Table 5.**
Gynecologic Procedures Performed by Gynecologic Oncologists by Period

| Procedure      | Overall 2019 (n = 473) | Overall 2020 (n = 348) | % change | Period 1 (March 16 - May 17) 2019 (n = 211) | Period 1 (March 16 - May 17) 2020 (n = 111) | % change | Period 2 (May 18 - June 23) 2019 (n = 120) | Period 2 (May 18 - June 23) 2020 (n = 97) | % change | Period 3 (June 24 - July 31) 2019 (n = 142) | Period 3 (June 24 - July 31) 2020 (n = 140) | % change |
|----------------|-------------------------|------------------------|----------|------------------------------------------|------------------------------------------|----------|------------------------------------------|------------------------------------------|----------|------------------------------------------|------------------------------------------|----------|
| Hysterectomy   | 262 (55.4%)             | 189 (54.3%)            | −27.9%   | 115 (54.5%)                              | 74 (66.7%)                               | −35.7%   | 67 (55.8%)                               | 47 (48.5%)                               | −29.9%   | 80 (56.3%)                               | 68 (48.6%)                               | −15.0%   |
| Hysteroscopy   | 33 (7.0%)               | 24 (6.9%)              | −27.3%   | 14 (6.6%)                                | 3 (2.7%)                                 | −78.6%   | 9 (7.5%)                                 | 3 (2.7%)                                 | −66.7%   | 10 (7.0%)                                | 14 (10.0%)                               | 40.0%    |
| D&C/D&E**      | 39 (8.3%)               | 27 (7.8%)              | −30.8%   | 18 (8.5%)                                | 3 (2.7%)                                 | −83.3%   | 10 (8.3%)                                | 8 (8.3%)                                 | −20.0%   | 11 (7.8%)                                | 16 (11.4%)                               | 45.5%    |
| Myomectomy     | 1 (0.2%)                | 0                      | ###      | 0 (0.0%)                                  | 0 (0.0%)                                 | 0.0%     | 0 (0.0%)                                  | 0 (0.0%)                                 | 0.0%     | 1 (0.7%)                                  | 0 (0.0%)                                 | −100.0%  |
| Endometriosis  | 0                       | 1 (0.3%)               | N/A      | 1 (0.3%)                                  | 0 (0.0%)                                 | 0.0%     | 0 (0.0%)                                  | 0 (0.0%)                                 | 0.0%     | 1 (0.7%)                                  | 0 (0.0%)                                 | N/A      |
| Laparoscopy    | 276 (58.4%)             | 211 (60.6%)            | −25.6%   | 124 (58.8%)                              | 72 (64.9%)                               | −41.9%   | 74 (61.7%)                               | 60 (61.9%)                               | −18.9%   | 78 (54.9%)                               | 79 (56.4%)                               | 1.3%     |
| Cystectomy     | 2 (0.4%)                | 5 (1.4%)               | 150.0%   | 1 (0.5%)                                  | 2 (1.8%)                                 | 100.0%   | 1 (0.8%)                                  | 2 (2.1%)                                 | 100.0%   | 0 (0.0%)                                  | 1 (0.7%)                                 | N/A      |

*Percentages in each column do not add up to 100% since some cases included multiple listed procedures. Percentages in parentheses refer to proportion of total cases as indicated by the n-value in each corresponding column header.

**These numbers represent cases performed in the gynecology operating rooms and do not include additional procedures performed on the Labor & Delivery floor.**
increase, and comment on whether management for ectopic pregnancy during the early months of the pandemic deviated from prepandemic evidence-based protocols.

Future studies are needed to better capture underlying consequences of this pandemic and its effect on gynecologic surgical care. This will require more extensive chart review and possible patient surveys to characterize the impact of surgical delays on patients’ disease process and psychological well-being. Additionally, understanding patient perceptions on emergency department visits and physical contact with providers could identify areas on which to focus future studies and direct patient counseling efforts to maintain safety during a pandemic. Finally, further evaluation of the indications and outcomes for surgical emergencies such as torsion, early pregnancy loss, and ectopic pregnancy is warranted. This will help to determine if the observed changes in the surgical numbers reflect a delay in presentation and subsequent increased acuity, possibly shifting the need for surgical treatment over more conservative management options.

The decrease in surgical numbers is a direct response to careful deliberation and directives from our institution, reflecting what we intended to do as a department. However, detailed examination of the types of cases, pathology, and individual patients is necessary to learn from experience and better inform future policies. During later surges of the current pandemic, our approach has been different so as to avoid negatively impacting patients as with the first surge. Policies are expected to continue allowing outpatient day surgeries with restrictions only for elective cases anticipating overnight admission. Use of validated gynecologic surgery scoring systems to determine which cases require urgent surgery, which can be delayed, and which can proceed during periods of surge would help to better ration resources and provide justice for our patient population.9

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